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Modern Shop Practice in the Building of Revolving Flat Cards

Details of Special Machines Developed for the Work—Production Cost Per Unit Lowered by Efficient Shop Arrangement, Careful Machine Designing and Standardization

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BEFORE taking up the details of manufacture of the modern revolving flat card, it may be of interest to trace briefly the development of this machine in order that one may better appreciate the extent to which the art of its manufacture has been developed.

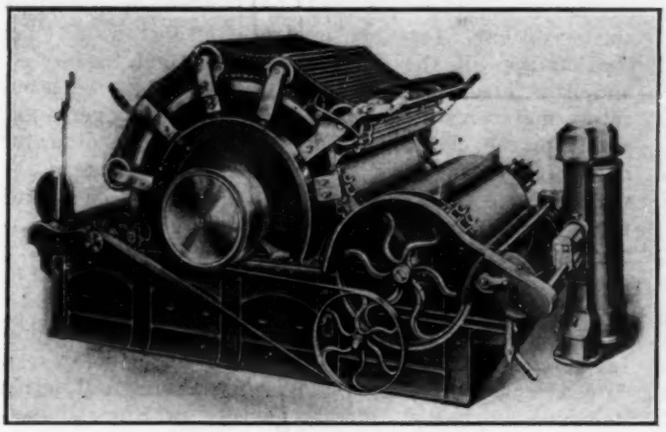

FIG. 1. MODERN REVOLVING FLAT CARD.

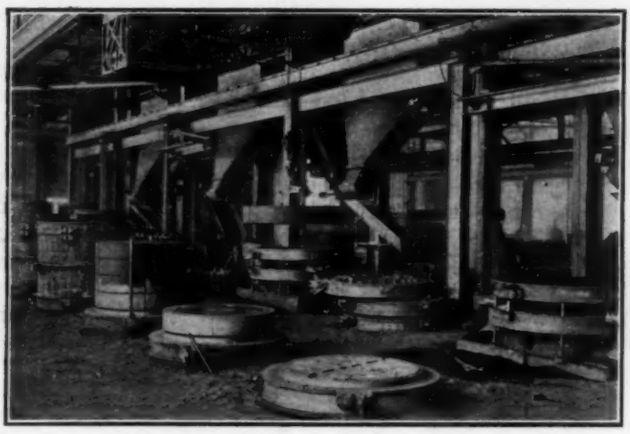

FIG. 2. CYLINDER MOLDING FLOOR

The primitive method of carding or cleaning cotton fibers was by means of hand cards, which consisted of brushes made of short pieces of wire instead of bristles, the wires being fastened into a sheet of leather at a certain angle, and the leather fastened into a flat piece of wood about 12 in. long by 5 in. wide and provided with a handle. The cotton was spread upon the surface of one of these cards and then combed with another until all the fibers were straight, after which it was stripped off in the form of a roll.

The first attempt to card by the rotary motion of a cylinder was covered by the English patent taken out by Lewis Paul, in 1748, but it was not until 1790, when Samuel Slater, an Englishman who had settled in Pawtucket, R. I., built the first cards to be operated in this country, that carding or cleaning cotton fibers by machine was introduced here.

In 1857 Evan Leigh produced a card embodying all previous developments and having the additional advantage of being equipped with a mechanical device to automatically strip the tops or flats. This type, known as the revolving flat card, was destined to come into almost universal use and is today the standard of the world for carding cotton fibers. Although many modifications and improvements in the construction of this machine have since been made, its fundamental features remain the same.

In Fig. 1 is shown a revolving flat card as it is built today. While there are several different makes of these machines, varying somewhat in details of design, the essential features and characteristics are the same in all.

It was not until the year 1884-1885 that American manufacturers came to realize that the efficiency of this type of card was at least 100 per cent higher than the best of the wooden-top flat cards. As soon as this advantage was made apparent to mill owners the demand for these cards became large, and during the next decade English cards of this type were brought into this country by the shipload. It therefore became necessary for the American machine manufacturer to adopt this new design for his product in place of the old-style machine, in order to compete successfully with the English builders. He was not prepared to manufacture this radically different and highly developed machine. Many of its component parts were so designed that they were not readily adapted to machining on standard commercial types of tools. A start was made by purchasing from England such machines as were available, but it soon became apparent that it

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was up to the American manufacturer to devise and build special-purpose tools and equipment if he hoped to succeed against the English competitor.

It is the purpose of this article to show some of the results of the efforts in this direction by describing some of the more important machines which have been developed for this work. In designing these machines the one object which has been constantly borne in mind has been that they must not only do the work cheaper, but it must be of better quality.

One of the first requisites for economic machine shop production on a quantity basis is carefully molded uniform castings; otherwise satisfactory work cannot be obtained from the jigs and fixtures employed in holding the castings for the subsequent machining operations. For the average card casting with its more or less deep draws and flanges, the stripping-plate type of molding machine has been found best suited. An iron pattern once properly fitted to a stripping plate is good for almost a countless number of castings, and thus made their accuracy in no way depends upon the skill of the molder. In fact, an ordinary laborer can in a few days be taught to make as good castings from a stripping-plate pattern as a skilled molder who has served his time in a foundry.

Developments in molding machines in recent years have made it even possible to adapt the cylinder and doffer patterns to stripping-plate machines and in Fig. 2 we have a view of the cylinder floor showing some of these machines, and illustrating the method by which the molds are built up. This equipment consists of four jolt stripping-plate machines, the drag, the cope, the core and cheek, the first two being seen at the center and the right of the photograph. The molds are shown from the right to left in their successive stages of completion. To provide for the flanges on the inside surface of the cylinder, the core is built up in four sections, one of which is seen suspended from the overhead crane by which it is handled. Each section is built upon a cast-steel arbor which serves as a means for handling and also provides a support for the upper cores. After the cores are in place the cheek is lowered into position and the mold is then closed with the cope and ready for pouring. This is done through a central sprue passing down through the cores and thence through radial gates in the drag to the cylinder wall.

The Stripping-Plate Machine

A view of the card-side floor showing the pattern mounted on a stripping-plate machine at the right is seen in Fig. 3. The drags are made from this machine while the copes are rammed up on the plate at the left. In the foreground may be seen two drags ready for the cores to be set. Over 70,000 molds have been made from this pattern and it is still in serviceable condition.

After pouring, the molds are shaken out over gratings in the floor, through which the sand falls into hoppers located in the basement. Serving these hoppers is the sand-mixing machine or car, shown in Fig. 4. A hopper is located on the right from which a slow-moving feeder delivers the sand to the hopper of a bucket elevator mounted on the car. This elevates the sand to the mixing machine where it is riddled, tempered and mixed and then dropped on to a belt conveyor which delivers it to the bucket elevator at the left ready for the hopper over the molding floor above. This sand car is operated on a track, running the length of the foundry and so located that the car serves all of the hoppers in the bay in which it operates. This equipment does away with the laborious work of shoveling the sand and it also mixes and prepares it much more thoroughly than is possible by hand, thereby producing not only better but cheaper castings.

For transportation of materials, an electrically operated monorail system has been installed. Not only are the cars electrically driven but the switches are also operated in this manner, being controlled by a button in the operator's cab. Special cars are also arranged with ladles for carrying the molten iron from the cupola to the molding floors, and arranged so that the tilting of the ladle for pouring is done by the operator of the car. This system has aided materially in reducing the cost of transportation, as well as increasing the capacity of the foundry by speeding up the work.

Machining the Castings

Upon the solid construction, the true running and the perfect balance of the card cylinder, depends to a large degree the successful operation of the card. Its surface is covered with card clothing, which in turn is set to run but a few thousandths of an inch away from the surfaces of the lickerin, the flats and the doffer, and it is essential that this small clearance be accurately maintained, as otherwise serious damage might result to the clothing. This cylinder has a diameter of 50 in., a length of 40 or 45 in. according to the width of the card, and runs at a normal speed of 165 turns per minute. It is the largest of the parts entering into the assembly of the card and its machining operations are such as require the use of several of the special single-purpose tools heretofore mentioned.

The first operation on the cylinder consists of squaring up and boring out the ends to receive the spiders. For a long time this was done on boring out lathes designed and built for this purpose in England, several of which were purchased and brought to this country.

Then in order to obtain an increased production, and at the same time eliminate the possibility of inaccuracy, it was decided that a milling machine was the type best suited to produce these results. Accordingly the special machine shown in Fig. 5 was designed and built for this work. The cylinder is held on an expanding arbor or chuck, one end of which carries the feed gear corresponding to the rack of the ordinary milling-machine table. The cutters are mounted on the inner ends of two spindles, one on each side of the machine, these spindles, in turn, being driven by spur gears from a motor-driven cross-shaft at the rear. The spindles are mounted in quills so arranged that they may be fed into the ends of the cylinder to the desired depth after it has been rolled into place. A sliding-drive pinion is then moved into mesh with the feed gear on the chuck, this pinion being driven from the cross-shaft shown on the side of the machine. A tight and loose pulley on this shaft receives a belt from a pulley on the motor shaft, the feed being started and stopped by the shifting of this belt. The arbor on which the cylinder is mounted is held in position in the horizontal U-shaped bearings of the machine by means of the steel wedges shown. The photograph shows the cylinder ready to be rolled into position. The head carrying the cutter spindles is adjustable and when once

set for a certain diameter of cutter, work of uniform dimensions is produced and is not dependent on the care of the operator, who merely loads and unloads the machine. This machine is capable of finishing one

FIG. 3. CARD SLIDE MOLDING MACHINES.

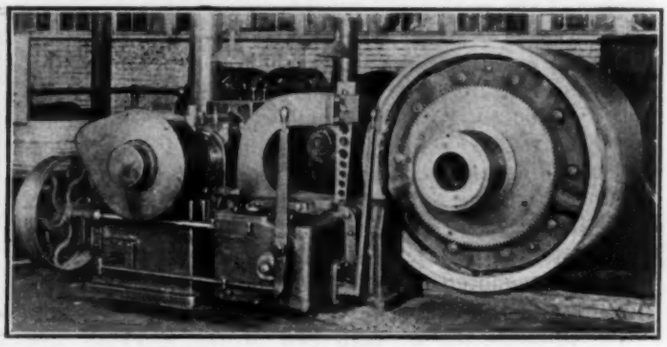


FIG. 5. CYLINDER-END MILLING MACHINE

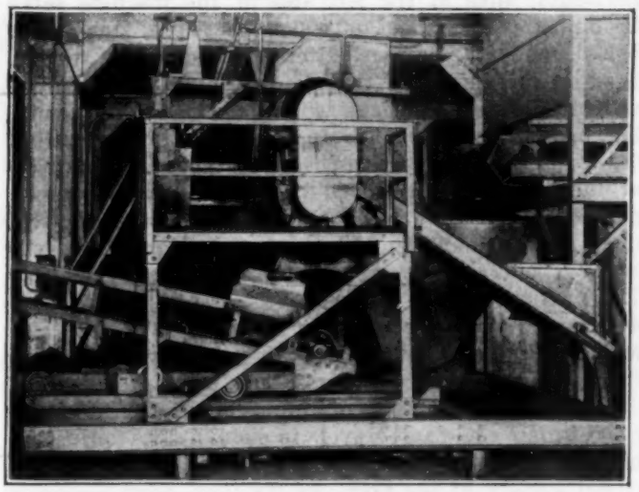


FIG. 4. SAND MIXING MACHINE

cylinder per hour, one-third the time required on the previous lathes.

When bored or milled out the cylinder is taken to the roughing lathe (Fig. 6) where it is held by the bored ends and a roughing cut is taken across its outer surface. To convey an idea of the size of this machine, it may be of interest to state that the head and tail-stock spindles are both 30 in. in diameter, the former carrying a driving gear 6 ft. in diameter. The spindles are of cast iron and run in cast-iron bearings, which have shown no appreciable wear during ten years of continuous service. The toolblock carries six tools spaced at equal intervals so that each tool travels but one-sixth of the length of the cylinder, the entire surface being finished by this movement.

A spider is then driven into each end of the cylinder where it is securely bolted and doweled in place. The holes are then line-reamed to receive the shaft, which is pressed into place in a heavy horizontal power press, 0.005 in. being allowed for the forced fit. As a further precaution, a $\frac{3}{8}$-in. dowel pin is driven through the hub of the spider and shaft at the driving end. This method of construction obviates any possibility of the shaft becoming loose from long-continued operation and insures a true-running cylinder.

It is then mounted on its own bearings in a special finishing lathe where a continuous chip is taken from one end to the other with a single tool, after which it is ready to be drilled for the wooden plugs which are driven into its surface and to which the clothing is tacked. This drilling operation is performed in the horizontal gang-drilling machine shown in Fig. 7. The drills used here are of the flat type and so shaped as to drill and ream a tapered hole suitable for receiving the wooden plug.

After plugging, the cylinder is carefully ground on a special cylinder grinder. Operations on the spider,

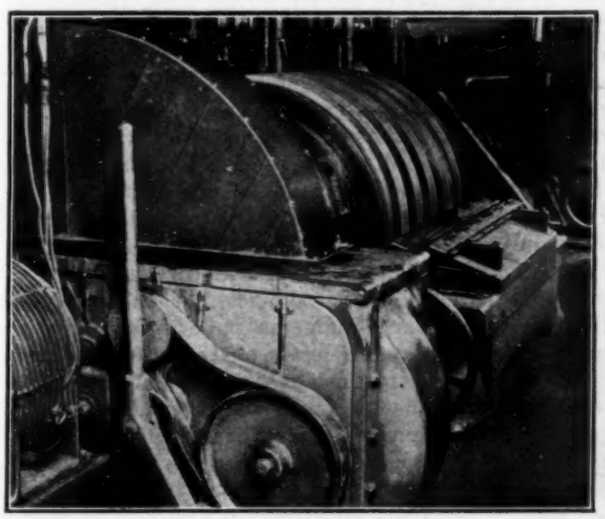


FIG. 6. CYLINDER ROUGHING LATHE.

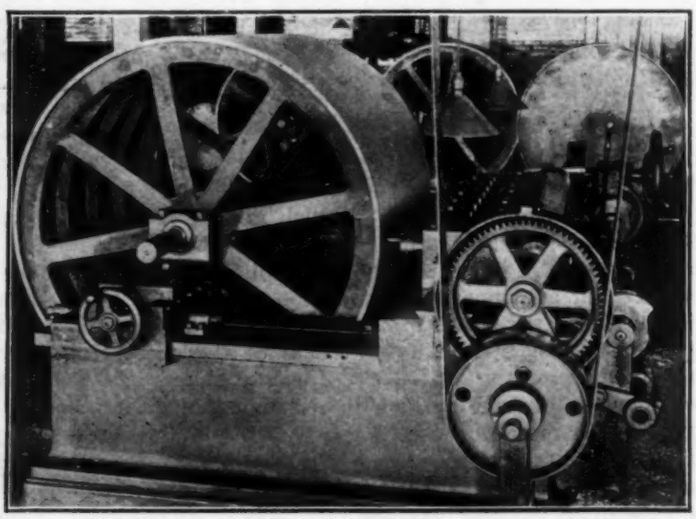


FIG. 7. CYLINDER DRILLING MACHINE

consisting of boring and reaming the hub, of turning the outside circumference to size and of facing one side of the rim, are done on a boring mill so equipped that all of these operations may be performed at one setting of the work.

The shafts used in the cylinders and doffers are of cast iron and each end is finished to three different diameters, one to fit the spider, one the bearing, and the third, or outer one, the pulley. For rough-turning these shafts the special machine shown in Fig. 8 was developed to turn both ends of the shaft at the same time. As will be seen, the central head carries a hollow spindle driven by a gear on the main driving shaft at the rear of the machine. On each end of this hollow spindle is mounted a special concentric chuck for centering and gripping the casting to be turned. The tailstock spindles, one at each end of the machine, are arranged in horizontal turrets or drums which may be rotated in their respective heads and whose axes are located below that of the driving spindle. These turrets are also fitted with a rotating center drill, the driving gears of which are thrown into mesh as it is moved up into line with the axis of the shaft. The third position of the left-hand turret carries a stop which locates the work in the machine, while the corresponding position of the right-hand one is provided with an opening through which the work is passed into and out of the machine. Each carriage is provided with a front and back toolblock, the former carrying two turning tools, while the latter carries a single inverted one. Thus, three tools are in operation at each end of the shaft, one for each of the three diameters.

The shaft then goes to a lathe equipped with two carriages, each of which is fitted with a toolblock arranged with tools for squaring the shoulders to length. It is then ready for the grinder where both ends are carefully ground to size. After cutting the keyway for the driving pulley with a vertical end mill, the hole for the oil screw is drilled and tapped in the end and the shaft is completed, ready to be pressed into the cylinder.

Finishing the Doffer

The operations of finishing the doffer follow closely those of the cylinder, the rough-turning being done on the machine shown in Fig. 9, which greatly resembles the cylinder roughing lathe (Fig. 6). After the spider and shaft are in place, the doffer is drilled, ground, and balanced in a manner similar to the cylinder.

The sides and arches of the framework of the cards are finished by special machines, since the successful manufacture of these parts requires close adherence to accuracy in order to insure interchangeability and to reduce to a minimum the fitting required in the erecting room. In order to secure a straight and even surface on which to erect the card and attain proper alignment of the bearings, the top surfaces of the sides are further finished on a special planer type of grinder carrying a vertically mounted motor-driven ring wheel.

The arch which is that portion of the frame carrying the stands that support the flats and their driving and adjusting mechanism as well as the sheet-iron casing below them, is by the nature of its design, the most awkward as well as one of the most important parts of the card to machine. The proper settings of the different parts require the accurate location of the various spottings on which the stands are mounted. The first operation after squaring off the bottom of the feet is the milling of the outer rim, this being done on the machine shown in Fig. 10. The rotating drum carries a pair of these arches, one right and one left hand. As this drum rotates slowly the circumference of the rim of the arch is carried past the cutter, plainly seen in the photograph, while below this cutter, but hidden from view, are two face mills so located as to mill the inner and outer sides of the rim. Means are also provided for automatically changing the space between these two cutters to allow for the thicker portion of the rim on one side of the arch.

Final Operations on the Arch

The final operations on the arch are accomplished at one setting on the machine shown in Fig. 11. The casting is clamped to the table in a horizontal position on its back and the pair of cutters mounted on the horizontal slide at the left side of the machine serve to mill the spottings to which the arch stands are bolted, while the pair of cutters carried on the vertical head in the center of the picture finish the spottings on both sides of the flange. In addition to these milling operations, the holes for the capscrews securing the stands in place are drilled and tapped. The table of the machine is revolved by hand to its successive positions under the horizontal cutters, while the vertical milling, drilling and tapping heads are free to swing about the central axis to any desired position. The locations of the various spottings and holes are all determined by tapered slots in the rim of the table into which plungers, mounted on their respective heads, are thrust to locate the spotting or hole to be finished.

Against the outer rim of the arch, the flexible bend, over which the flats travel, is held by its adjusting blocks. It is essential that this bend be close to the milled surface of the arch and its sides must therefore be true and even. The finishing of these sides is accomplished, as in the case of the rim of the arch, by feeding the bend between two properly spaced face mills and removing the scale from both sides of the casting at the same time. This operation is shown in Fig. 12. It will be noted that this machine is of a type similar to some of the continuous milling machines which have been recently developed, where the loading and unloading is carried on while the machine is in operation. A rough casting may be seen entering the cutters, while in the rear the finished one is just coming into sight. The cutters are hidden from view in the cut, but are mounted on the ends of the spindles, one on each side of the machine. Large-diameter pulleys for driving the cutters are mounted directly on the outer ends of these spindles. This method of driving a milling cutter directly by means of a belt has been found very efficient, in as much as it eliminates vibration and tendency to chatter caused by a gear drive, the belt producing a certain cushioning effect. Cutters thus driven require less frequent grindings and may be operated at a higher speed than those driven through a train of gears.

Power for driving the card is applied to the main cylinder shaft where a pair of 20-in. tight- and loose-webbed pulleys receive the belt. On the other end of the shaft an 18-in. pulley serves to drive the lickerin and flats. These pulleys require a considerable amount of machine work in as much as each is made with one or more grooves on one side for driving a round belt in addition to the crowned face. The outer

FIG. 8. SHAFT ROUGHING LATHE.

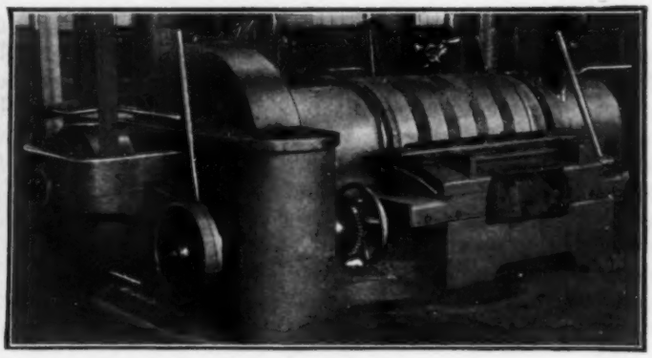


FIG. 9. DOFFER ROUGHING LATHE

sides of the webs are also turned. A special lathe, Fig. 13, was developed for doing this work by forming tools which carry cutters the full width of the surfaces to be finished. Special attention is called to the massive design of this machine, the headstock spindle being 16 in. in diameter. The heavy heads absorb

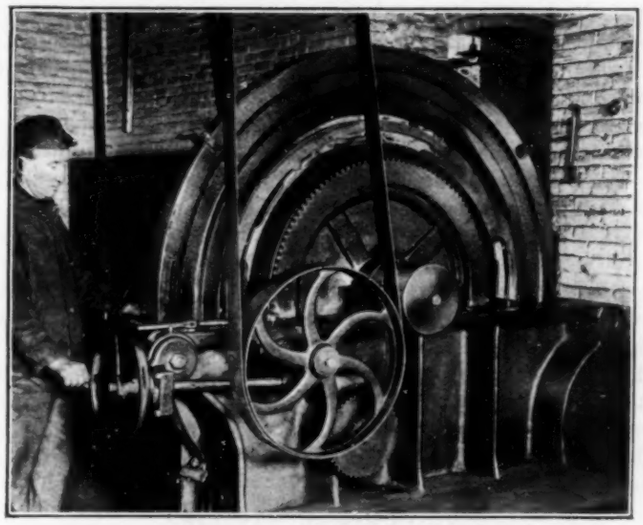


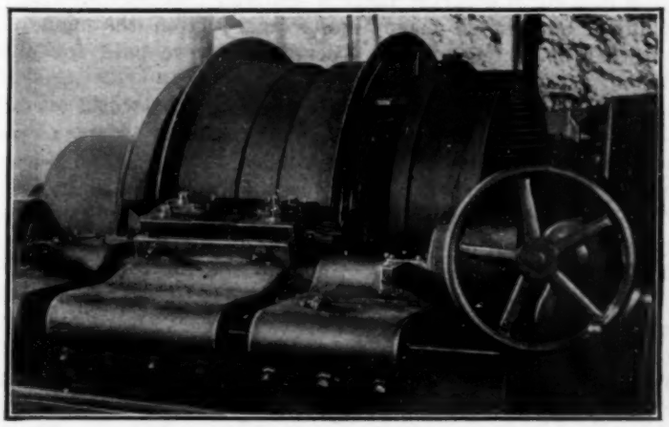
FIG. 12. FLEXIBLE BEND MILLING MACHINE

all vibration even under the heaviest cuts. A special toolblock is arranged for each operation, two of which are shown at the base of the machine; the one at the left being used for forming the web and rim, while that on the right blocks out the grooves and half of the crown, the other half being finished in a second operation by turning the pulley around. A spring chuck clamps the pulley securely in place while turning. This machine also carries a boring bar by which the hole is bored and reamed while the turning operation is going on. The average time for finishing the pulley shown at the left of the machine is 11 minutes.

The boring out of the ends of the lickerin shell also proved to be an operation which could not be readily or economically performed on a commercial type of tool and many of the milling operations on the various smaller parts of the card are such as to require the use of gang or form mills. This is also true of many of the milling operations on other textile machines. For this class of work a semi-automatic milling machine is used.

Coming now to the erecting room, the cards are set up here in rows of twenty-five each as shown in Fig. 14. They are completely assembled with the exception of the clothing and the flats and are then run off and carefully inspected before boxing. Dowel pins are provided wherever necessary so that the work of assembling at the mill is reduced to a minimum.

From the foregoing descriptions and machines which have been illustrated, there are several points to which attention should be called. First, the all-important problem is to get the actual labor cost per piece as low as possible, consistent with the high standard of quality required. This problem is somewhat different from that of most production shops where the low cost of production is arrived at by getting as large a production per machine per day as possible. Many of these special machines are capable of turning out two, three and even four times the amount of work required and are therefore often stopped from one-half to three-quarters of the time. It has therefore been found advantageous to arrange the machines in groups so that one man by operating the group will produce the amount of work required from his machines.



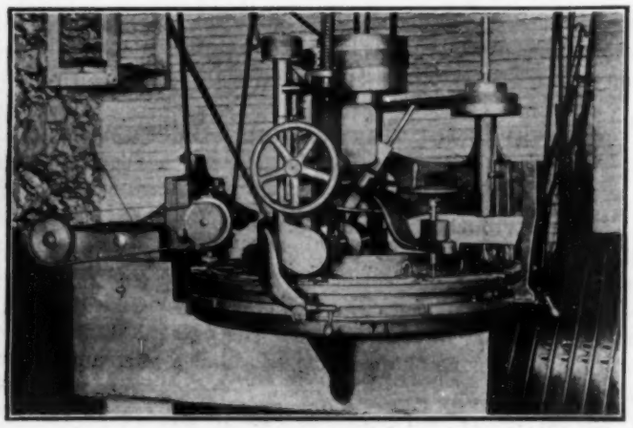


FIG. 10. ARCH MILLING. FIG. 11. ARCH MILLING, DRILLING AND TAPPING

Second, in designing the special machines it will be noted that extremely liberal dimensions have been allowed, and that the lathe and milling-machine spindles have been made to approximate as nearly as practical the diameter of the work to be turned, or the cutter carried by the spindle. In many instances these spindles are made of cast iron, running in bearings of the same material, the surfaces of which when glazed over are almost impervious to wear. The large masses of metal in these spindles, bearings and other parts have been provided so as to absorb all vibration and prevent any tendency to chatter even under heavy cuts and feeds.

Third, each machine is designed to do one or more operations on one special part and is suitable for no other purpose. Equipment of this kind is possible only where the product has been thoroughly standardized and is not subject to major changes in design.

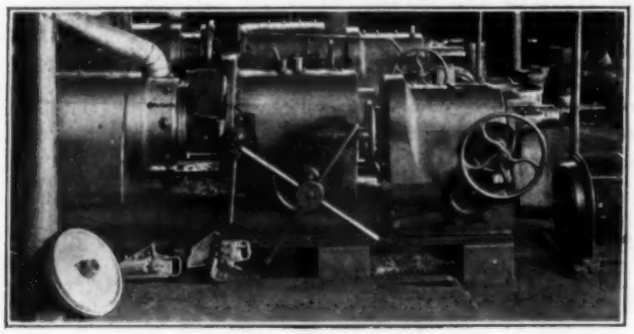


FIG. 13. PULLEY LATHE

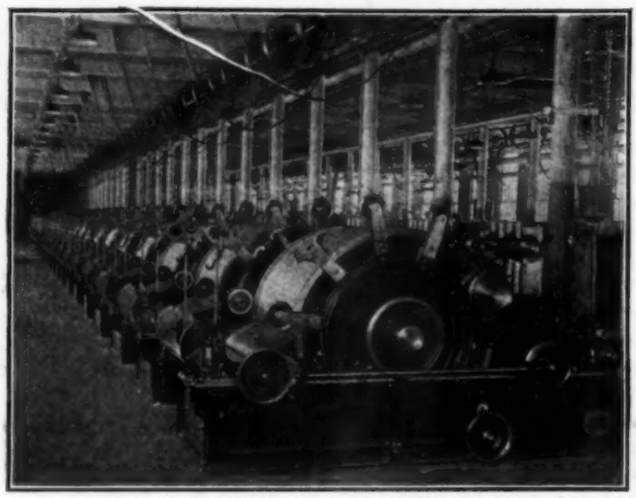


FIG. 14. ERECTING FLOOR

Rewards for Suggestions—Discussion

BY F. P. TERRY
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The contribution under the above heading by C. J. Morrison, on page 448, Vol. 55, of AMERICAN MACHINIST, deals with a subject which I think has been somewhat neglected of late, but which at the same time is one of the most important under the present difficulties, and may be termed as making two blades of grass grow instead of one.

As Mr. Morrison suggests, it is a square deal that is necessary first and last. Many schemes have been tried, many have died almost at birth for lack of some little link. In some cases it has been a jealous manager or foreman who has been at fault, in others, the reward has been inadequate to the saving affected. But this would seldom kill a scheme where proper recognition is forthcoming, apart from the monetary element.

MONEY, PROMOTION AND INCREASED SALARY POPULAR REWARDS

Some twenty years ago I was connected with a firm that had a very popular and successful scheme in operation. The money award was in most cases small, but promotion and increased salary were certain. In one case, a machinist who was milling brush parts for a motor developed a new design that was taken up by the firm. His reward was promotion to the position of foreman of the brush making department, a position practically created for him. Soon he came along with other suggestions and he eventually became head foreman of the electrical department.

A suggestion from a turner of a special chuck to allow for the machining of engine eccentrics at one setting brought as a reward an assistant foremanship in the machine shop, which resulted later in other improvements and the official position of jig and fixture designer. There were also dozens of other cases of men getting increased wages and better machines to operate.

Ten years ago the old manager died and the suggestion scheme lingered for a few months then passed away. The new manager had the idea that he could do all the suggesting himself, or at least take all the credit.

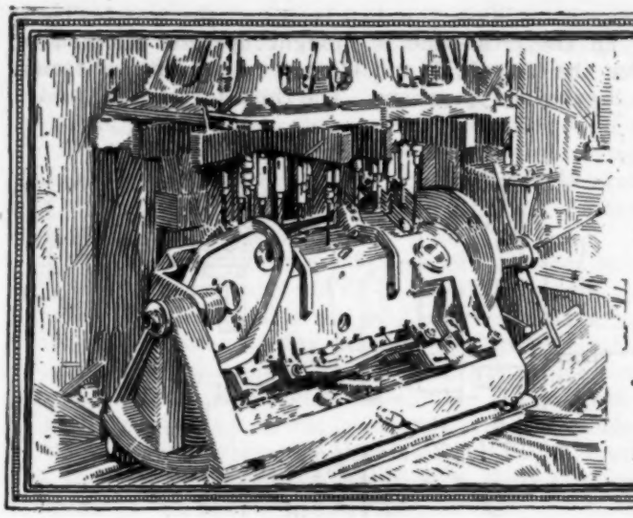
Mr. Morrison proposes a committee of judges. While this may be successful, I think the manager alone should have the necessary powers and be the sole judge. If the manager is not broad enough to carry out this important part of sucessful management, he should be replaced, as also should foremen who use their position to crib and claim the ideas belonging to others.

A BROAD-MINDED MANAGER

In the control of the successful scheme mentioned above, the old manager took full charge. Any ideas put before him were carefully considered and when adopted were often considerably improved by his own suggestions, for which he never claimed the slightest credit but gave all honor to the originator. All awards were recorded in the works magazine published quarterly. Anything especially good would be described fully with the inventor's photograph, or sometimes inventors would be invited to describe their inventions themselves. This added additional charm, quite apart from the money element, although these descriptions were paid for at liberal rates.

Human nature is very much the same the world over, and nothing is so annoying as being robbed. Many men would kick up more fuss if robbed of one dollar than they would if they were to lose fifty. It is the robbing of men's ideas that is the great drawback to so many suggestion schemes and that keeps work from being done on up-to-date lines, to the loss of the firm and the world at large.

If we had more broad-minded managers always ready to forget personality when it is to the firm's advantage, as in the case mentioned above, we would have many more successful suggestion schemes and contented workers. The pity is that such managers are so scarce.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Methods of Designing Tools for Turret Lathes Continued—Different Ways of Developing the Design—Detailed Layouts for Pulley and Bevel Ring Gear

THERE are several methods of making turret layouts. Some factories show a simple yet complete set-up, with all the tools in place on the turret. Others go a step further and show the turret set-up with tools on one sheet, while on another each operation is shown in detail with the tools in their respective positions. There is still another method in vogue, which shows all the tools on the turret and each operation in detail on the same sheet. In addition to this, all tool numbers and reference numbers to drawings on which tool details appear are given on the sheet, and each operation is specifically noted by means of reference letters on the various surfaces which are to be machined.

In selecting a method, the tool engineer should be governed partly by factory conditions and the procedure in the past. Judgment must be used in the matter and a suitable method selected and standardized in order to obtain uniformity. If tool layouts are blueprinted and made up in book form for factory reference, the sizes of sheets should be uniform and of such shape that they can be easily handled.

In Fig. 379 is shown a turret layout of a plain pulley with all the tools in position on the turret. Figs. 380 and 381 show the various operations in detail. Referring to Fig. 379, the work *A* is a plain pulley which is to be turned, bored and faced on both sides. It is held by the inside of the rim in a set of special chuck jaws *B*, which are so made that the facing tools on the cross-slide can pass by the edge of the flange without interference. The toolholder *D* contains a boring bar, corner tool and turning tool for the outside diameter, all being used for the roughing operation.

The holder *E* is a duplicate of *D*, except that it is used for finishing, and the corner tool is left out because one cut is sufficient to do the work. Holder *F* contains a reamer which is arranged so that it will float and follow the hole generated by the boring tools. Tools *G* and *H* are standard slide tools, which are used for rough- and finish-facing the back of the pulley hub. The cross-slide in this machine has a turret toolpost *K*, in which are held the tools used to face the front of the hub and both sides of the flange.

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The starting and completing of the first operation on the pulley is shown in Fig. 380. The cross-slide tool *L* is first used for facing off the end of the hub. After this cut has been started, the turret is brought up until the boring bar pilot enters the bushing and the boring tool commences to cut. Soon after this the turning tool *M* comes into operation. About this time the facing tool *L* has completed the work on the end of the hub; it is therefore withdrawn and the turret toolpost indexed to allow the two facing tools *O* and *P* to be used on the sides of the flange. Meanwhile the boring and turning tools continue to cut, eventually completing their work, at which time the "knock-off" stops the turret slide. Hand feed is then used to round the corner of the hub with the tool *N*.

In Fig. 381 is shown the remainder of the operations in detail. The cross-slide tools continue to face the flange while the finish-boring bar and turning tool *Q* in the holder *E* on the second turret face are brought up and set to work. The knock-off on the cross-slide stops the slide at the proper point and the facing tools remain in the position shown, or they can be run back out of the way if desired.

The hole is reamed with an adjustable reamer *R* in a holder of the floating type. On a cast-iron piece such as that shown, the reamer is usually fed by hand in order to size the hole more rapidly. If a slow machine feed is used, there is always the possibility of enlarging the hole slightly, due to the scraping action on the edges of the blades. The production is faster if the reamer is fed by hand, and the work is more uniform.

The last two operations on the work are rough- and finish-facing the back of the hub. A bar *S* inserted in the slide-tool *G* is operated by hand in a vertical direction. The turret is brought against a stop to obtain the correct longitudinal position, and held in place during the operation.

Many turrets have six sides, but there are also those with five, four and three. The majority of the machines in common use have either six or four sides, although on certain kinds of work the others are often used. Some years ago a certain type of turret lathe was made with an eight-sided turret; but this type was

not used very generally as its field was limited, due to the possibility of interferences of turret tools with others on the cross-slide of the machine. The six-sided turret occasionally causes trouble in this regard, so that the tool engineer must keep his eyes open in order to make sure of the necessary clearances.

A four-sided turret allows more tool clearance and there is little chance of trouble being caused by a lack of room for the tools. Fig. 382 shows a layout for a piece of work *A* which is to be handled on a machine having a turret with four sides. The piece is held by the inside of the rim in a set of special jaws *B* in a three-jaw chuck, in which the bushing *H* is fixed to act as a guide for the boring bars and reamers. The holder *C* is fastened to the first turret face and has an extension bracket *D*, in which are carried the turning tools *E* and *F*. Fine adjustment is provided by means of the backing-up screws shown.

The tools in the holder are set vertically, although for convenience they are shown in a horizontal plane in the layout. A rough-boring bar *G* is held in the same holder and used for boring the hole in the hub. The front of the cross-slide has a special toolblock *K* in which are held the facing and grooving tools *L*, *M* and *N*. These latter are roughing tools used for making the first cut on the flange, facing the end of the hub and roughing out the groove $\frac{1}{32}$ in. under the finished size.

The toolholder *O* on the second turret face is exactly the same as that used on the first turret face, but it finishes the surfaces roughed off in the previous operation. While this tool is in use, the rear toolblock *T* on the cross-slide is brought up into position, so that the tools *U*, *V* and *W* perform the finished-facing and grooving operations. The third turret face carries

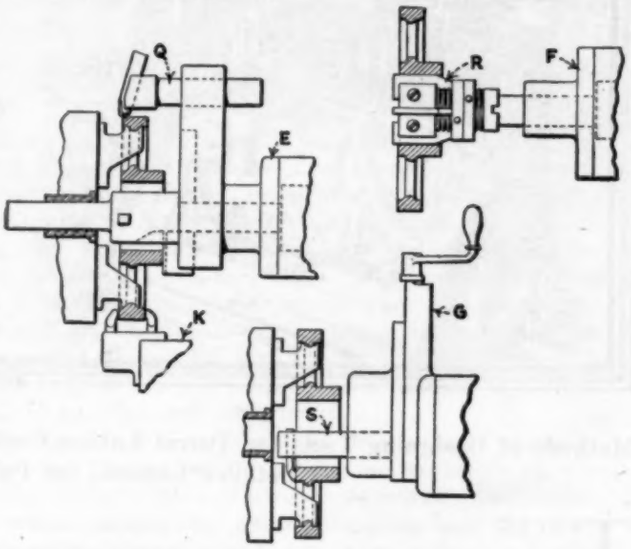


FIG. 381. REMAINDER OF OPERATIONS ON PLAIN PULLEY

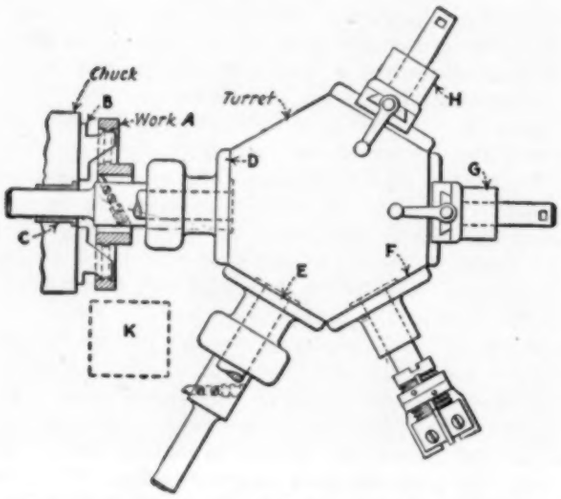


FIG. 379. TURRET LAYOUT FOR PLAIN PULLEY

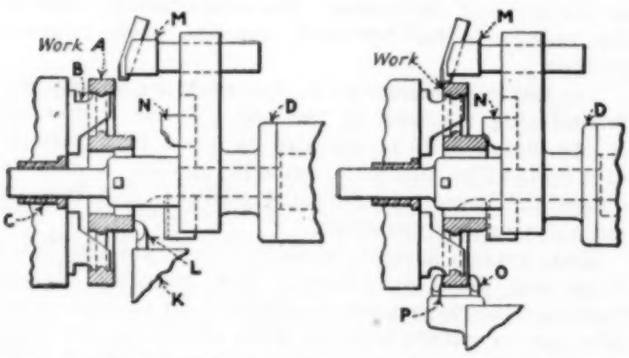


FIG. 380. START AND COMPLETION OF FIRST OPERATION ON PLAIN PULLEY

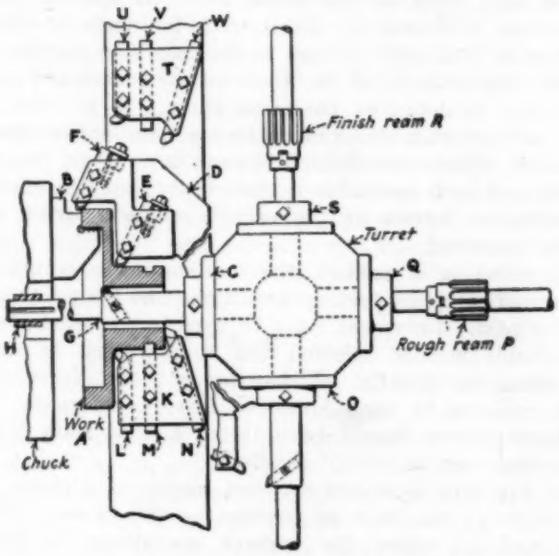


FIG. 382. TURRET LAYOUT FOR MACHINE WITH FOUR-SIDED TURRET

a roughing reamer *P* which is supported in a floating holder *Q*. The fourth and last turret face has a holder *S*, which is also of the floating type and carries the finishing reamer *R*.

This use of two reamers, one for roughing and the other for finishing, is not common, yet it is used occasionally when very accurate work is required. In this layout of tools the attention of the designer is called to the operation of the turret turning tools and the cross-slide facing tools, as the lengths of the various cuts are so nearly the same that the turning and facing operations are completed at practically the same time with the equipment indicated.

In order to illustrate the application of one of the methods of making turret layouts, we give a complete layout in Figs. 383, 384 and 385 of a special equip-

ment used in machining a bevel ring gear for the rear axle of an automobile. Fig. 383 shows the work *A*, which is a drop forging of alloy steel, held by the outside in a set of special chuck jaws *1*. These jaws are undercut, so as to grip the work firmly and prevent it from being pulled out of the jaws during the cutting. The surfaces which are being machined are lettered, and all tools used are numbered and listed at the bottom of the layout sheet.

A brief description of each operation, together with a reference to the portions of the work on which the cuts are being taken, is given with each layout showing details of the set-up. For example, the first operation consists of rough-boring the hole *G* with a special boring bar *4*, and rough-facing the surface *F* with tool *2* in the turret toolpost of the cross-slide. The remainder of the operations shown on this sheet are clearly specified and all tools used are listed with their drawing numbers at the bottom of the sheet, so that tool drawings can be easily found when wanted. The title of the drawing and other information as to the work and the machine on which the tools are used is given in the lower right-hand corner of each drawing, in the usual manner.

Between the first and second turret lathe settings, the bolt holes are drilled in the face *F* which has just been machined. This provides a means of driving the work during the heavy cutting of the beveled faces. In order to make this layout clear, a description of the holding device is necessary and some mention of the other tools used in Fig. 384. The work is located on a large special arbor *7*, which is fitted to an adapter on the spindle in such a way that it can be trued up when necessary if it does not run perfectly true with the spindle. The arbor is provided with a pin which enters one of the bolt holes and acts as a driver. A taper plug in the center of the arbor acts upon three shoes which expand in the hole and grip the work and center it at the same time.

A locating device *8* is mounted on one of the turret

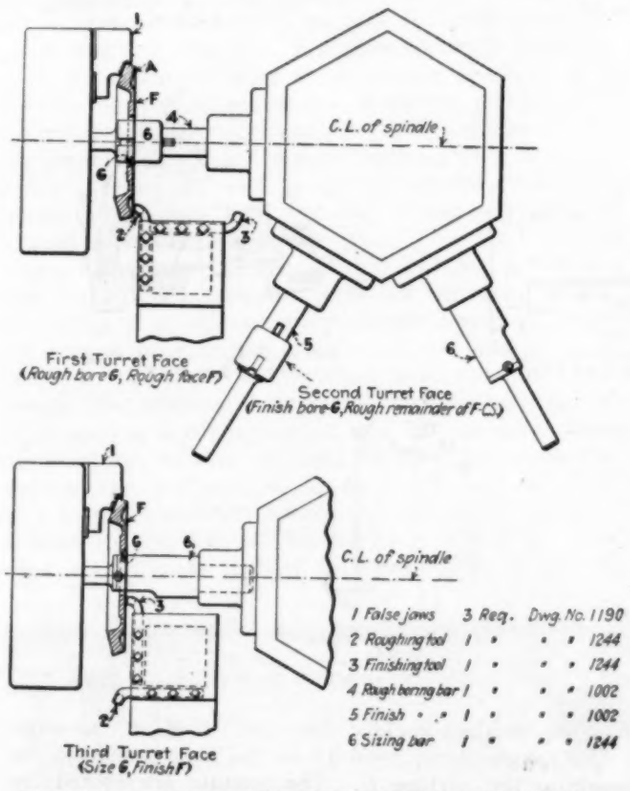

C.L. of spindle
First Turret Face
(Rough bore 6, Rough face F)
Second Turret Face
(Finish bore 6, Rough remainder of F.C.S.)
C.L. of spindle
Third Turret Face
(Size 6, Finish F)
1 False jaws 3 Req. Dwg. No. 1190
2 Roughing tool 1 " " " 1244
3 Finishing tool 1 " " " 1244
4 Rough boring bar 1 " " " 1002
5 Finish " " 1 " " " 1002
6 Sizing bar 1 " " " 1244

FIG. 383. TURRET LAYOUT FOR BEVEL RING GEAR—FIRST SETTING

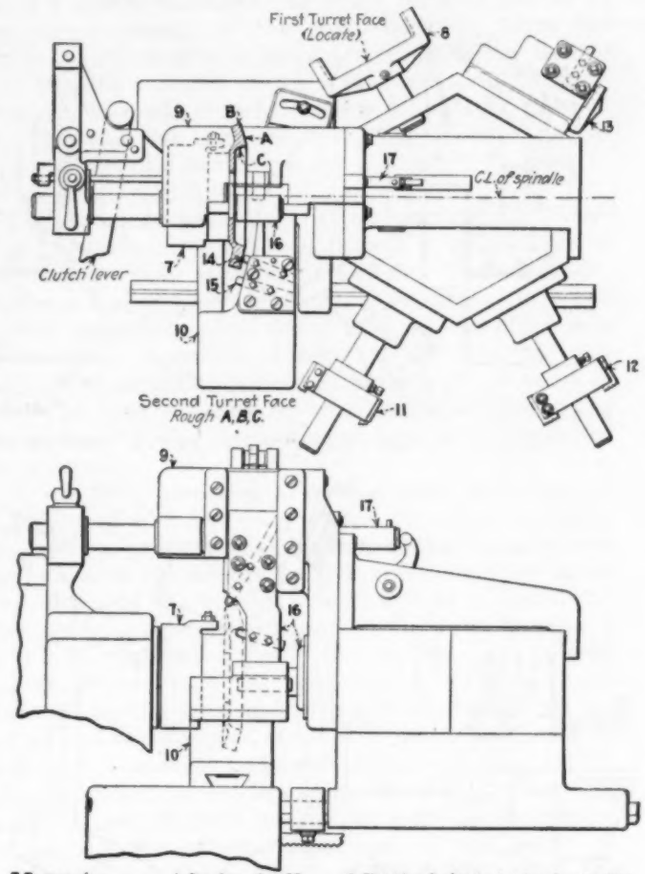

First Turret Face
(Locate)
C.L. of spindle
Clutch lever
Second Turret Face
Rough A, B, C.
7 Taper arbor 1 Req. Dwg. No. 1137
8 Locator 1 " " " 1137
9 Taper turning attach. 1 " " " 983
10 Taper cross slide 1 " " " 1194
11 Radius head 1 " " " 1251
12 Rough facing head 1 " " " 1244
13 Finishing facing tool 1 Req. Dwg. No. 1035
14 Roughing tool 1 " " " 1194
15 Finishing tool 1 " " " 1194
16 Special tool slide and guide for ring gear 1 " " " 1137
17 Taper bar for ring gear 1 " " " 1137

FIG. 384. TURRET LAYOUT FOR BEVEL RING GEAR—SECOND SETTING

faces and used when setting up the work on the arbor, in order to hold the piece up against the shoulder and preserve the correct location. In the first operation in this setting, a special taper turning attachment *9* (which was described in detail in a previous article) is used for turning the back angle and boring the inside angular surface of the gear blank shown as *B* and *C*. A special toolblock is mounted on the slide for this work, and because of the excessive overhang a support *16* is provided, in order to give the necessary stability and prevent any vibration.

A special taper cross-slide *10* is used for rough- and finish-facing the face angle of the gear *A*, the two tools *14* and *15* being used for the work. These tools are set far enough apart so that the roughing tool has completely finished its work before the finishing tool starts. The tools *11*, *12* and *13* are used for roughing the inside surfaces of the blank. The combination of a special cross-slide with a taper turning attachment on the turret increases the production greatly and gives very accurate work, as all the surfaces are machined by single-point tools controlled by accurately set taper forms.

The remainder of the operations are shown in detail in Fig. 385. The taper cross-slide continues to work after the turret taper attachment has been withdrawn. The turret is indexed and the radius cutter head *11* which is being cut is tough and "wirey" so that the radius at the cutting point of the tools is nicked to break the chip and make the cutting action easier. The grooves in one tool overlap those in the other, so

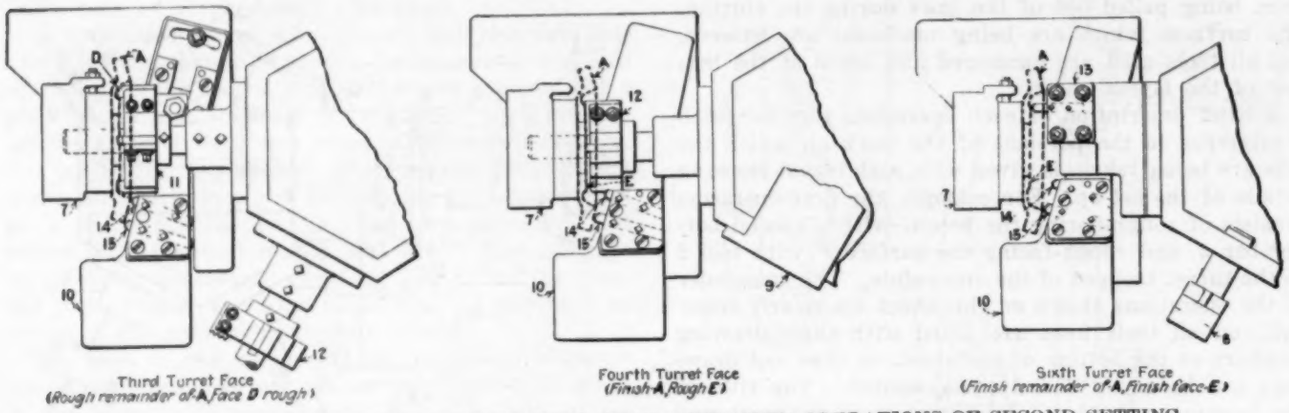

Third Turret Face
(Rough remainder of A, Face D rough)
Fourth Turret Face
(Finish A, Rough E)
Sixth Turret Face
(Finish remainder of A, Finish face E)

FIG. 385. TURRET LAYOUT FOR BEVEL RING GEAR—DETAILED OPERATIONS OF SECOND SETTING

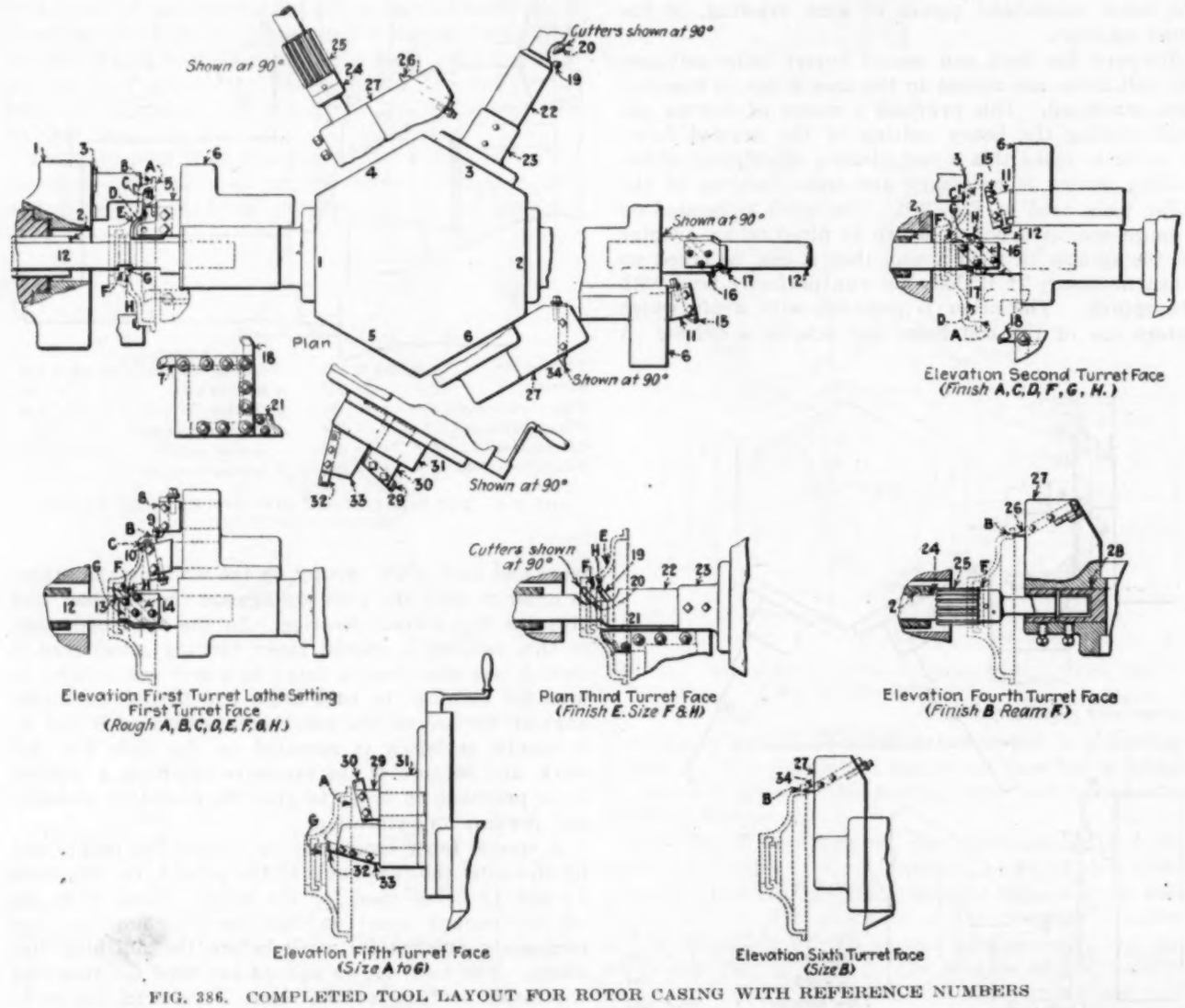

Shown at 90°
Cutters shown at 90°
Plan
Shown at 90°
Shown at 90°
Shown at 90°
Elevation Second Turret Face
(Finish A, C, D, F, G, H.)
Elevation First Turret Lathe Setting
First Turret Face
(Rough A, B, C, D, E, F, G, H.)
Cutters shown at 90°
Plan Third Turret Face
(Finish E. Size F & H)
Elevation Fourth Turret Face
(Finish B Ream F)
Elevation Fifth Turret Face
(Size A to G)
Elevation Sixth Turret Face
(Size B)

FIG. 386. COMPLETED TOOL LAYOUT FOR ROTOR CASING WITH REFERENCE NUMBERS

is used to remove the stock from the curved portion of the blank *D*. The tools in this cutter head are arranged so that they do not interfere with the continued action of the taper cross-slide. The material that the finished surface does not show any grooves.

The rough-facing head *12* is the next tool used for roughing the surface *E*. The toolbits are nicked the same as the radius tools to break the chip, and the

tool positions are such that the cross-slide continues to work on the facing of the angle without interference. The blank has now been completely roughed where necessary and finished on all important surfaces except the portion *E*, which has only been roughed.

To be sure of an absolutely true surface at *E*, the work should be faced with a single-point tool; but as the cross-slide is set at an angle it cannot be used, and as the turret has no crossfeeding movement it is evident that it is not available. In order to overcome the difficulty, a special slide tool *13* is mounted on the turret so that a single-point tool takes the position shown ready for the facing cut on the surface *E*. This tool is brought up to its place just as the angular facing cut is completed by the cross-slide. The feed of the latter is reversed and a block on the cross-slide engages with a slot in the under side of the sliding member on the turret, thus causing the single-point tool to move across the surface to be faced and producing a true and accurate finish.

The entire equipment shown in these layouts is considerably out of the ordinary and it is not by any means cheap; yet all of the tools are so designed that they can be adapted to a number of different pieces of work, so that the cost distributed over the various parts is not excessive. Furthermore, the work produced is of great accuracy, which is an essential item in the manufacture of bevel gears and pinions. The production is very rapid, and there is little time wasted either in setting-up or in machining.

Another Method of Making Layout

When it seems desirable to show a turret layout and details of the various operations on the same drawing, the arrangement must be carefully studied in order to avoid confusion. As these layouts are used in the factory, they should be as clear as possible so that the persons who use them will be able to understand the tooling methods readily. Fig. 386 shows a complete layout for a turret lathe operation on one-half of a rotor casing for a gyroscopic compass. This work required great accuracy and the tool equipment was designed with this point in mind, although a number of standard toolholders were used because the production required is not very high and only a few parts of any one kind are machined at one time.

The work is held by the outside in a set of special chuck jaws *3* in a standard three-jaw universal chuck. The casting is of an aluminum composition and somewhat fragile, so that the position of the jaws in their relation to the work was selected with care in order to avoid distortion. A universal turning and facing head *6* holding a boring bar *12* and various other tools designated by number, is used first on the work for roughing the surfaces *B*, *C*, *E*, *F*, *G* and *H*. The tool *7* in the cross-slide turret toolpost is fed outward and used in roughing off the surfaces *A* and *D*. The second operation is that of finishing *C*, *F*, *G* and *H* with another toolholder on the turret, and a final cut is taken across *A* and *D* with a tool *18* in the cross-slide.

The third operation finishes *E* and sizes *F* and *H* using a special boring bar *22* and a forming tool *21* on the turret toolpost of the cross-slide. In using the latter the cross-slide is located against a longitudinal stop and the tool fed outward by hand until the indicating dial on the crossfeed screw shows that the correct diameter has been obtained. The operators would allow the tool to dwell here for a moment in order to obtain a smooth finish.

The fourth operation is that of reaming the hole *F* with the reamer *25*, which is held in a special floating holder in the body of the toolholder *27*. This toolholder carries a tool *26* used for roughing the groove *B*, which is very important as it fits a bead on the other side of the case. Attention is called to the fact that this tool is held vertically instead of horizontally in order to obtain as high a degree of accuracy as possible. The importance of this arrangement has been mentioned previously.

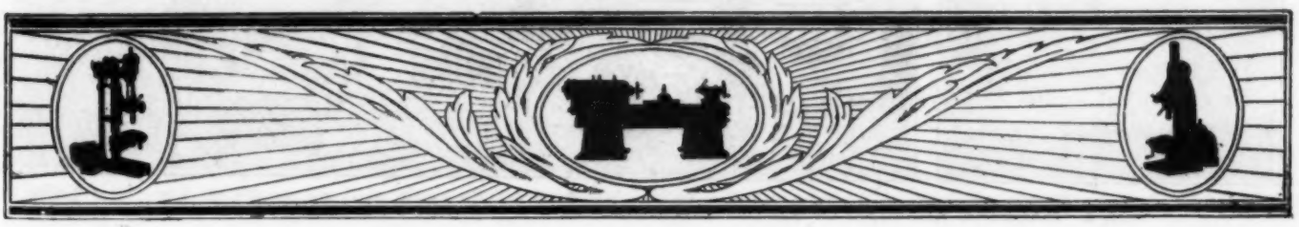
In the fifth operation a vertical slide toolholder *31* is furnished with two tools *30* and *32*, which are accurately set to preserve the accuracy of the distance from the face *A* to the surface *G*. The sixth operation is the final sizing of the groove *B* with tool *34* in holder *27*. This sizing is the last operation on the work, because it is of such importance that it is desirable to do it alone and thus make sure that no changes in relation can occur due to the possible shifting of the work.

The various examples of layouts given in this article cover a considerable variety of work, and the methods described are all in use in various factories. A decision as to the most suitable method for a given shop should be reached only after a discussion of the merits of each and a knowledge of conditions which affect the situation. Speaking generally, the writers favor the process shown in Figs. 383, 384 and 385, largely because the operations are shown so clearly, and the sheets are so proportioned that they can be photostated and bound up in a loose-leaf letter-size book for convenient reference.

The Foreman's Authority

By A. W. Brown

This is often an undefined thing; not exactly *x*, the unknown quantity, but at least a quantity of which the true value is not understood by those of whom he is in charge. Sometimes, indeed, the foreman himself has no sure comprehension of exactly where he stands and of how readily and how far the management will back him up, should he unwittingly overstep his authority. Nor does he know whether they will endorse his actions, should he exert his authority to the utmost. This matter should be made clear alike to the foreman and to those under him.



Reo Aluminum Alloy Pistons

Machining Methods Practically the Same as with Cast-Iron Pistons—Snap and Dial Gages Used for Inspection—Selective Assembly in Cylinders

By FRED H. COLVIN
Editor, American Machinist

THE Reo shop is one that has been successful in using aluminum alloy pistons, handling them in much the same way as cast iron. The first operations are to disk grind the ends, face and bore the open end and center the head, holding the piston from the inside so as to secure a wall of uniform thickness. A semi-automatic machine is used to rough-turn the outside and to rough out the ring grooves at the same time. This operation is shown in Fig. 1, which also shows the kind of chips that come from the alloy. The open end is then rebored, true with the roughed outside, and the inside chamfered.

The finish-turning and grooving is done on a similar machine at a second operation, after which the head is roughed and finished. Re-centering comes next, followed by three grinding operations which include the taper at the upper end.

Cross-boring for the piston pin is done in the chuck

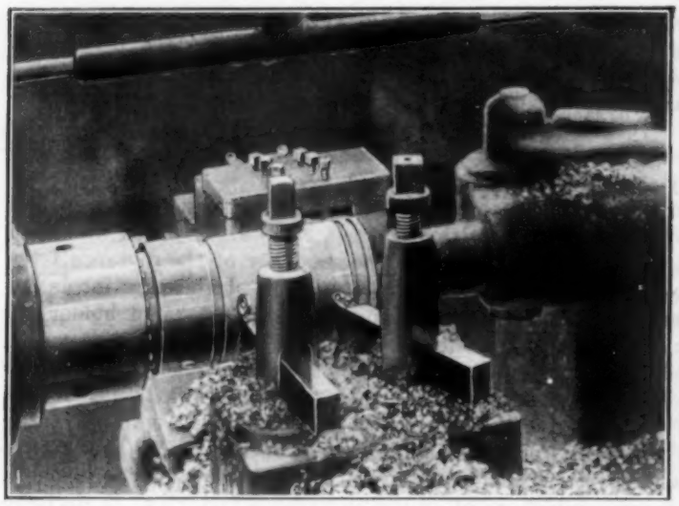


FIG. 1. TURNING AND GROOVING ON SEMI-AUTOMATIC MACHINE.

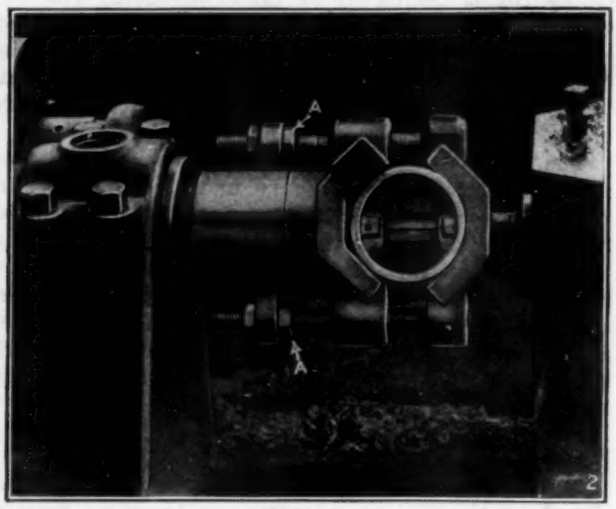


FIG. 2. BORING THE PISTON-PIN HOLE

Cross-boring for the piston pin is done in the chuck

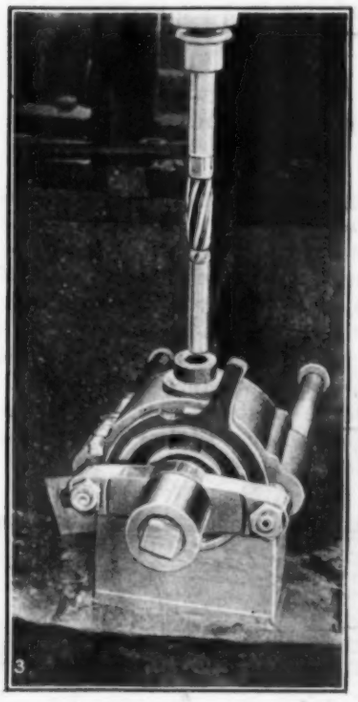


FIG. 3. MACHINE REAMING OF PISTON-PIN HOLE.

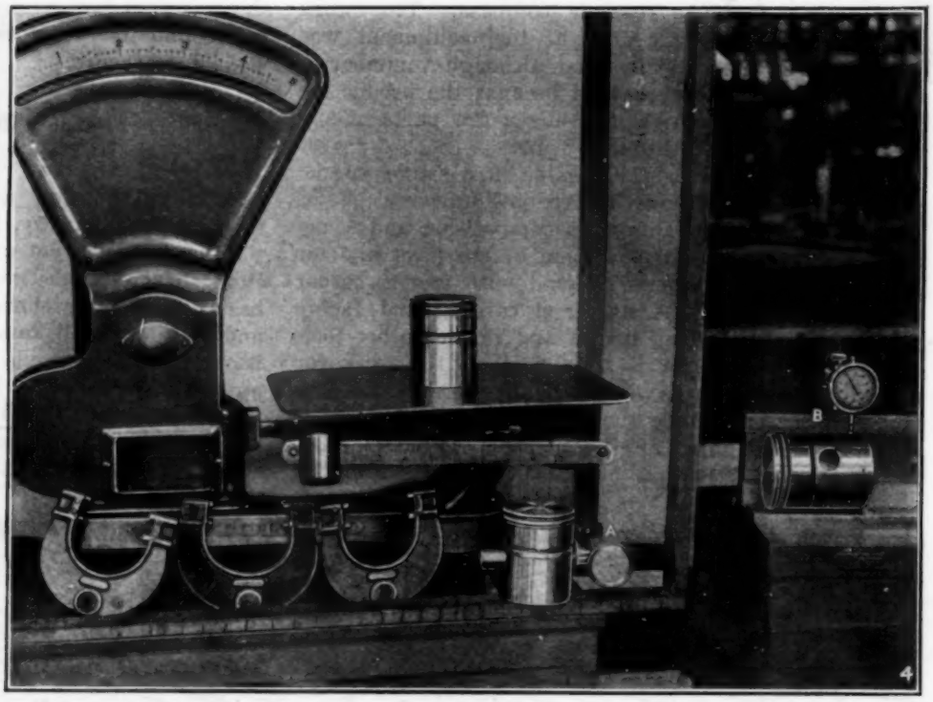


FIG. 4. SCALES AND INSPECTION GAGES

shown in Fig. 2. The check nuts on the back of the studs at *A* and *A* prevent drawing the outer clamp too tight and distorting the piston. The bosses are faced in the usual manner and the piston washed and carefully burred before inspection. The machine reaming is done in a special fixture, Fig. 3. The crossbar in front slides forward to release the piston.

The ring grooves are carefully inspected and the piston weighed on the scales shown in Fig. 4. The piston is again washed, the pinhole hand reamed to size and then washed a third time. The rings are fitted to the piston in the assembly line and returned to the bench for the rest of the operations.

In Fig. 4 are also shown a number of the inspection gages used on the piston. The snap gages test the diameter and the width and depth of ring grooves. The gage at *A* tests the squareness of the hole with the piston. The dial gage is fastened to the large diameter of the plug and when turned to indicate both above and below the hole, it tells the story of squareness of the hole with the body. Roundness is tested at *B* where the piston is revolved under the gage as it lies on the angle plate shown.

The method of fitting the pistons, or rather of selecting the pistons for any given motor, is shown in Fig. 5.

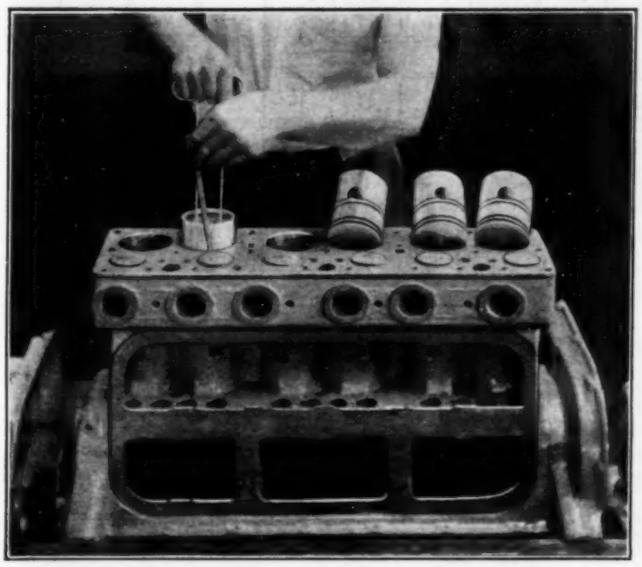


FIG. 5. TESTING PISTON CLEARANCE

A convenient wire handle enables the operator to get the "feel" of the piston in the bore when the feeler of proper thickness for the clearance is in place beside the piston. This view also shows the large exhaust valves; the inlet valves are in the removable head.

Planing Flat Gibs—Discussion

BY J. M. HENRY

The article under the above title, on page 219 of AMERICAN MACHINIST and the criticism thereof on page 408, led the writer to investigate the methods employed for planing similar pieces in our plant.

It seemed that the bending of gibs was not the proper method, as the correction made to overcome the springing tended to set up other strains that would have to be compensated for in some manner. Also, it seemed that considerable care was required to get just the right amount of bend to take care of the "wind."

Some time ago the planer department became dissatisfied with our methods on this class of work, both as to time and finished results. After some experimenting the following method was tried out and has proved so satisfactory that it has been practiced ever since in planing thin cast-iron gibs, both parallel and taper, and on work of similar character.

The castings as they come from the foundry are planed on one edge and then laid on the planer table in their natural position, shimming up where necessary to make them bear solidly. The planed edge is placed against a block or strap with a bunter against the opposite unfinished edge bearing just a little above the center of the piece, the object being to force the finished edge against the solid support without putting in a "wind" or "twist."

Careful clamping is, of course, nine-tenths of the job, but in this case it is comparatively simple. On long pieces, blocks and bunters are used near the ends only and no effort is made to clamp the piece down on the table, as the edge friction may be depended upon to hold it in place.

After clamping, the upper surface is roughed and *finished*. When released the gib naturally takes a "wind," that is commonly supposed to be caused by the scale pulling in on the unfinished side after the strain on the opposite side has been released by the removal of the scale. The piece is then laid with the finished side against the table, *forced* down flat and the remaining wide side *finished* to bring the piece to proper thickness. The result is that in the second operation the strains set up by the first are compensated for and the finished piece is found to be flat, parallel and free from twist or wind. Theoretically this seems reasonable and has been demonstrated to work out in practice.

No one would believe this to be true when it was first suggested, but when the inspector was handed a lot of pieces, half of which were finished by this method and the other half by the old method of roughing all over and then papering up for finishing, he could not tell the difference. In fact he picked out many pieces machined the new way as being the most perfect. The saving of time is obvious and it is a fact that very little scraping is found to be necessary, as all gibs are straight and to standard sizes.

Steel gibs and flat plates are generally finished on the vertical surface grinder, as oftentimes where size is unimportant it is necessary only to skim the surface. Cast-iron gibs or plates not to be held to a definite dimension are also ground. The only reason why the surface grinder and magnetic chuck is not generally used for thin cast-iron gibs lies in the fact that it is almost impossible to make thin flat castings with a surface good enough to supply a minimum allowance for grinding, and still leave enough stock to obtain an accurate thickness. For this reason it is found to be better practice to leave about $\frac{1}{8}$ inch for finish, and plane to size in this way. Large cast-iron tables, approximately $1 \times 24 \times 60$ in. have been successfully planed in the manner described, without a trace of wind.

In some cases long steel plates are milled and then finish ground to size following the method of holding at each end in a vise and depending upon side clamping only, bracing from the under side at the ends and center and allowing the piece to take its natural position.

There is not as much wind produced in milling as there is in planing, but when it appears the piece is forced down on the table before taking the second cut. When finished, the work is invariably flat and parallel.

Methods of Machine Tool Design

Continuation of Third Article—Machine Tool Drives—Some of the Possible Combinations of Gears and Countershafts—Beginning a Problem

By A. L. DeLEEUW

AN UNLIMITED number of combinations is possible, using such elements as fast and slow countershafts, cone pulleys, fast and slow back gears, fast and slow triple gears. More than two countershaft speeds can be used, and have been used; it is possible to put a speed variator in the countershaft; it is also possible to have two cone pulleys in the countershaft. Such combinations have appeared from time to time; some have been discarded while a few still survive; and, where it is possible to use them, such combinations may produce very desirable results. However, there is one item which must be constantly kept in mind when we use more than one countershaft speed and even with the use of an ordinary set of cone pulleys, and that is, that the amount of power delivered to the machine is not constant. If, for instance, we have a machine cone and countershaft cone, each with a large step of 12 in. and a small step of 6 in. for, say, 4-in. single belt, and supposing the countershaft to run 300 r.p.m. then the large step of the countershaft cone is capable of delivering 5½ hp. If the belt had been on the small step of the cone, the amount of power delivered would be only half as much, or 2⅝ hp. Not only have we here a wide variation in the amount of power which the countershaft can deliver, and consequently in the amount of work the machine can do, but, as a rule, we have the maximum amount of power when the minimum is required, and vice versa.

Supposing that the above-mentioned cones were used in a lathe, then we would have the high speed of the

a	ar	ar^2	ar^3	ar^4	ar^5	ar^6	ar^7	ar^8	ar^9	ar^{10}	ar^{11}	ar^{12}	ar^{13}	ar^{14}	ar^{15}	ar^{16}	ar^{17}	ar^{18}	ar^{19}
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

1 To 16 All In Cone

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Slow Countershaft								Fast Countershaft							
Back Gear								Direct							

or

1	3	5	7	9	11	13	15	2	4	6	8	10	12	14	16
Slow Countershaft								Fast Countershaft							

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Slow Back Gear						Fast Back Gear						Direct					

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Back Gear and Slow Countershaft				Direct with Slow Countershaft				Back Gear and Fast Countershaft				Direct with Fast Countershaft							
Back Gear and Slow Countershaft				Back Gear and Fast Countershaft				Direct with Slow Countershaft				Direct with Fast Countershaft							
Triple Gear				Slow Back Gear				Fast Back Gear				Direct							

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Slow Triple Gear				Fast Triple Gear				Slow Back Gear				Fast Back Gear				Direct			

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Slow Back Gear and Slow Countershaft			Slow Back Gear and Fast Countershaft			Fast Back Gear and Slow Countershaft			Fast Back Gear and Fast Countershaft			Direct with Slow Countershaft			Direct with Fast Countershaft		
Slow Back Gear and Slow Countershaft			Fast Back Gear and Slow Countershaft			Direct with Slow Countershaft			Slow Back Gear and Fast Countershaft			Fast Back Gear and Fast Countershaft			Direct with Fast Countershaft		

or

VARIOUS COMBINATIONS OF DRIVING ELEMENTS

lathe when the belt is on the large countershaft step, and the low speed when it is on the small step. Now, as a rule, we do the heavier work when the lathe is running at the lower speeds and this is exactly when we obtain the least amount of power.

The same thing happens when we have variable-speed countershafts and this defect becomes more marked the greater the difference in the countershaft speeds. For that reason countershaft speeds widely varying in the number of revolutions per minute are not often used.

The table on the preceding page shows some of the combinations which are possible when we use such elements as fast and slow countershafts, cone pulleys, slow and fast back gears, and slow and fast triple gears.

As was mentioned before, many other possibilities exist, and some of the groupings given here would not be practical except in some extraordinary cases. The first line shows the various speeds we would obtain up to and including twenty speeds. The second line shows the numerals by which we refer to these speeds in the various groupings. The first possibility is that all of the speeds (16 and sometimes more) are obtained by the cone steps only. This, of course, is not a practical arrangement, though there are cases where as many as nine steps in a cone are used in very practical constructions—for instance, speed variators for a grinder.

The second group uses either a pair of cone pulleys combined with slow and fast countershaft or such cone pulleys with back gear or direct drive. Here, again, it is not very likely that eight steps will be used in the cone, but the general nature of the drive remains whether we use eight or only three steps in the cone.

The next group refers to a pair of cone pulleys and again slow and fast countershaft, of a somewhat different arrangement. In the previous arrangement the fast countershaft was not used until all the speeds of the cone had been exhausted with the slow countershaft speed. Such an arrangement is not very practical unless the speed variation obtained in the cones alone is relatively small. In the arrangement shown, the fast countershaft speed is $r^8 \times$ the slow speed, and this would either mean an excessively high countershaft speed or an excessively low speed. In the present arrangement, however, the countershaft speeds alternate with the cone steps. For instance, if we have the belt on the third step and with the slow countershaft speed, we will obtain the next higher machine speed by leaving the belt on the third step but changing over to the high counter speed. The next higher machine speed will then be obtained by shifting back to the low counter speed and also shifting the belt to the fourth step of the cone. In this arrangement the ratio of the countershaft speeds is r. Such an arrangement is quite frequently used because we may use then the low counter speed for roughing and the high speed for finishing, obtaining these speeds without having to shift the cone belt and merely handling the shipper rod.

The next case shows a pair of cones, one countershaft speed, two sets of back gears and a direct drive; the next, two countershaft speeds, two cone pulleys and back gears. Here, again, we have a large difference between the two counter speeds, which makes this arrangement unsuitable except for very special cases. In general, the tabulation shows what arrangements are possible, though not necessarily desirable.

In Figs. 16, 17 and 18 a number of groupings were shown for two, three or four shifts. The number of shifts which should be selected for a machine depends on circumstances. If the work done by the machine calls for frequent shifting of speed within a narrow range, then it is well to control this entirely with one shift. If, on the other hand, there is a frequent shift,

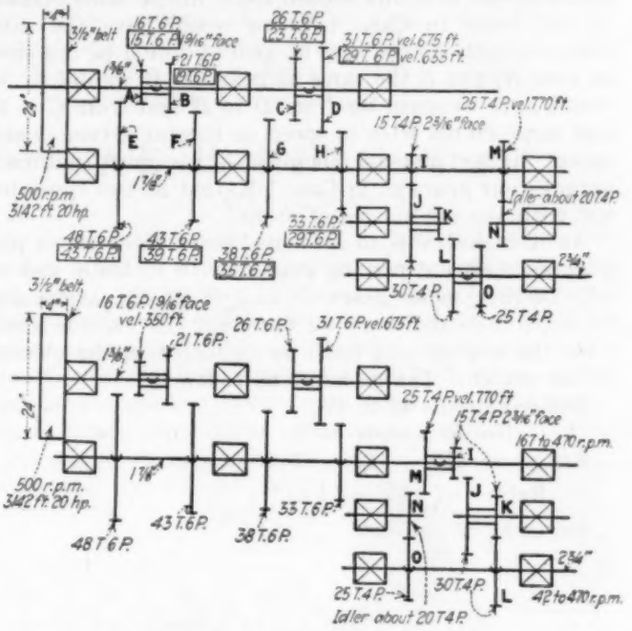


FIG. 20-A. FIRST ARRANGEMENT OF EIGHT-SPEED GEAR CHANGING DEVICE (ABOVE). FIG. 20-B. BETTER ARRANGEMENT OF FIG. 20-A

say from roughing to finishing feed (which is probably more than the variation one could get in one group), then it is well to bunch the finishing feeds and also the roughing feeds together, each in their own group, and have a single shift from roughing to finishing. No general rules can be given in regard to this matter and if we wish to illustrate the analysis of a gear-changing device, we must assume certain conditions and proceed accordingly.

In Fig. 20A a gear-changing device is shown with eight speeds. There is a driving pulley on the first shaft which, we will suppose, runs 500 r.p.m., giving a belt speed of 3,142 ft. per minute and capable of transmitting 20 hp. There are two pairs of sliding gears which can be made to mesh either with an idler or with a pair of compound gears which, in their turn, mesh with a pair of gears keyed to the second shaft. This arrangement may or may not be the best we can get. It is, however, the first one we happen to think of and is therefore the starting point of our analysis.

We will assume that we desire to run the last shaft

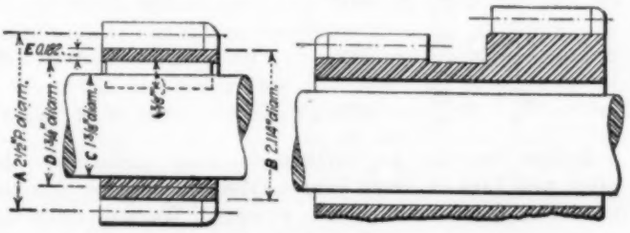


FIG. 21. STANDARD METHOD OF RECORDING PINION ANALYSIS

at a low speed of 42 and a high speed of 475 r.p.m. As we have two shifts we will have the same conditions as if we had a pair of cone pulleys and a set of back

gears; so that we can calculate at once what reductions we must make in the first shift and what in the second. The question remains whether we have the same as Case 1-A or Case 1-B. If we should make the sliding gears on the first and second shaft in the same manner as the cones in Case 1-A, we would have the same gears on both shafts, that is, gear A would be the same as gear H, and B the same as gear G. If we did so, we would have to speed up from D to H and from C to G, and as we do not wish to speed up in gear arrangements except under unusual conditions, we must naturally arrange our gears as in Case 1-B, that is, two cones but not with the same sizes of steps.

As it is desirable to have the gears as small as possible we start out making gear A with 15 teeth, and we will further make gears D and H of the same size. Under these conditions we find that the various gears have the numbers of teeth as indicated in the oblongs in the sketch. The calculations follow:

Desired speeds 42 to 470

No. of speeds $= 8$

Range $= 470 \div 42 = 11.2$

Ratio $= \sqrt[7]{11.2} = 1.412$

Sequence of speeds

a	ar	ar^2	ar^3	ar^4	ar^5	ar^6	ar^7
42	59.3	83.8	118	167	236	333	470
SLOW COUNTERSHAFT				FAST COUNTERSHAFT			

CASE 3

Range in cones $= r^3 = 2.8166$

Ratio of fast and slow counter $= r^4 = 3.98$ say 4.

Ratio of A and $E = r^3 = 2.8166$

A has 15 teeth

No. of teeth in $E = 15r^3 = 42.2$

$15 + 43 = 58$ T. in pair A and E

$$B = \frac{58}{r^3 + 1} = \frac{58}{2.395} = 19$$

$$F = 58 - 19 = 39$$

$$C = \frac{58}{r + 1} = 24$$

$$G = 58 - 24 = 34$$

$$D = \frac{58}{1 + 1} = 29$$

$$H = 58 - 29 = 29$$

$$ar^4 = \frac{470}{1} \times \frac{15}{43} = 164 \qquad a = 164 \div 4 = 41$$

$$ar^3 = \frac{470}{1} \times \frac{19}{39} = 229 \qquad ar = 229 \div 4 = 57$$

$$ar^2 = \frac{470}{1} \times \frac{24}{34} = 332 \qquad ar^2 = 332 \div 4 = 83$$

$$ar^3 = \frac{470}{1} \times \frac{29}{29} = 470 \qquad ar^3 = 470 \div 4 = 118$$

Before we can go further we must determine the pitch and face of these gears. We will assume that the reader is familiar with this process. We will make the gears of chrome nickel steel, heat-treated and hardened, because we realize right away that, in order to transmit 20 hp. at 500 r.p.m., we would need very large cast-iron gears of which the circumferential speed would be very much too high and soft steel gears would not be permissible on account of the tearing up of the metal under running conditions. We might have made these gears of mild steel and casehardened, or of tool steel and hardened, but the latter choice is unsuitable because hardened tool steel is brittle, and the former choice would be almost as expensive as chrome nickel steel and would not have nearly the same strength.

Making pinion A with fifteen teeth, six pitch, and therefore $2\frac{1}{2}$ in. in diameter, makes gear D with twenty-nine teeth, six pitch. As gear D runs 500 r.p.m. its circumferential speed is 633 ft. per minute. *Without resorting to special care in gear cutting, hardened steel gears may run up to 700 ft. per minute, when running dry.* Our arrangement is therefore acceptable.

However, comparing the load which the pinion *must* stand and the load it *can* stand, we find that pinion A is not strong enough. There are two things we can do: We can either increase the pitch or increase the number of teeth. The smallest possible increase in pitch would make the pinion fifteen teeth, five pitch, and, as we cannot change the relative sizes of A and D, the diameter of B also will be $\frac{6}{5}$ times greater, so that its circumferential speed will be $633 \times \frac{6}{5}$ which is more than 700 ft. per minute, and therefore not acceptable.

If, on the other hand, we change the number of teeth of pinion A, we increase it only $\frac{1}{15}$ or less than 7 per cent for every tooth added. Giving this pinion sixteen teeth reduces the load sufficiently to make such a gear strong enough, and, as this pinion is the smallest of the eight gears used in the set, all other gears are also sufficiently strong. The new figures thus obtained are placed immediately above the old figures in the oblongs. We find that the highest circumferential speed of any of the gears is now 675 ft. per minute, which is still below the maximum.

It might be remarked here that there are two shifts in the first group but this is only apparently so. The two sets of sliding gears can be handled with a single lever as is done in the gear-shift on automobiles. The reason why a single lever can be used for two pairs of sliding gears in one group is that only one of the four sliding gears is in mesh, all others run idle. If, on the other hand, gears A, B, E and F should belong to one group and gears C, D, G and H to another group, it would not be possible to handle these two sets of sliding gears with a single lever, because two sets of gears would be running at the same time.

The highest speed we have given to the second shift is 470 r.p.m. and the lowest speed 167 r.p.m. As the last shaft in the arrangement must have a low speed of 42 r.p.m., we find that we must reduce from 167 to 42, which is a ratio equal to 4. Such a reduction is very well possible with one pair of gears, but it would mean that the larger of the two gears would be of considerable size. In modern machine tool construction where gears are supposed to be inside of the frame of the machine (at least as much as possible), large gears are not desirable, and for this reason we will make this reduction by means of compound gears, indicated by I, J, K and L. The other side of this sliding gear arrangement, however, requires no reduction, so that we do not need any compounding. However, if we should drive directly from M to O, the last-mentioned gear would run in the opposite direction from gear L, so that we are compelled to insert the idler N.

As the highest speed of pinion I is only 167 r.p.m., and as it also has to transmit 20 hp., we must calculate the proper pitch and face for this pinion. We find that we will have the necessary strength by making it four pitch with $2\frac{5}{8}$ in. face, using chrome nickel steel again

as our material. The real active face is only 2 in., as $\frac{1}{16}$ in. was allowed for the rounding of the teeth which is necessary where gears slide into mesh with each other. Similarly, the face of the first pinion, which was $1\frac{1}{16}$ in., has also an allowance of $\frac{1}{16}$ in. for rounding. It should be noted here that *the face of a gear should not be more than three times its circular pitch and, if possible, should be confined to two-and-a-half times the circular pitch.* There are cases where we deviate from this rule, but every case should be treated individually and carefully analyzed before we make the face wider.

The reason why it is not advisable to have wide faces for gears is the following: However carefully shafts may be aligned, there is always some small amount of error. Besides, the pressure on the gear tooth or possibly on the teeth of some other gear will cause the shaft to bend, thus bringing the teeth of two meshing gears out of alignment. This will cause excessive pressure on the corners of the teeth, which are liable to break out. Actual practice shows that in the great majority of the breakage of gears it was the corner of a tooth which first gave way.

We will now check up and see if there is anything in the arrangement, as sketched out in Fig. 20A, which should be modified. Looking at the first pair of sliding gears we see that when it is in mesh on either side the working gear is close to a bearing, which is as it should be. But this is not the case with the compound gears. Where the gear *L* meshes with *K* is quite some distance from its bearing. Furthermore we notice that the sliding gear *L-O* is on the last shaft, that is, the shaft subject to the greatest torque; and it would be better to have all gears on this shaft solidly keyed on. We further notice that the gear *L* receives heavier pressure from the compound gears than the gear *O* from the direct drive, and we should always aim to place the gear which receives the heaviest pressure as close to the end of the shaft as possible. In other words, we should reverse gears *L* and *O*. We make these corrections and obtain Fig. 20B, which meets all the objections mentioned above.

There is one other point to which we should pay attention, namely, the idler. It would seem desirable to have the compound gears *JK* and the idler *N* in line with each other so as to be able to run a single shaft between the bearings for the support of these gears. If we do so, we must make idler *N* with twenty teeth. As a rule, it is not desirable to have an idler between two gears smaller than the gears themselves, though this is not a serious matter so long as the difference in the number of teeth is not too great. Twenty teeth, therefore, will do. However, should we wish to make this number greater we can readily do so, for we must not forget that Fig. 20B does not show the gears in actual relation to each other, but shows them as if they were all rolled out until the centerlines of their shafts came in one plane surface.

Mention was made of the analysis of the fifteen tooth pinion, which showed us the necessity of changing this to sixteen teeth. As this kind of analysis should be carried out with every gear, clutch, etc., which we need in a driving arrangement, we show in Fig. 21 a standard way of making such an analysis rapidly and in such a manner that a record may be kept. The sketch on the left shows the fifteen tooth pinion which does not need to be sketched to size, as we will depend entirely on figures. We put down the various sizes in the order indicated by the letters. *A* shows the pitch diameter, *B* the root diameter, *C* the diameter of the shaft, *D* the diameter over the key (or over the bushing, if the gear should be running loose on the shaft), and *E* the thickness of metal between the teeth and the key. This amount of metal being insufficient we changed the pinion to sixteen teeth and drew a new sketch as shown on the right.

(Continued in next week's issue.)

A Difficult Die Casting

By Milton Wright

A rather difficult proposition in the way of a die casting is shown in Fig. 1. It is of an aluminum alloy and, except for tapping the small holes for the assembling screws, is complete when it leaves the die. The picture shows two identical castings, one of them reversed to enable the reader to see both sides. The depth of the casting, the extreme thinness of the walls, together with the various shoulders, crossholes, offsets,

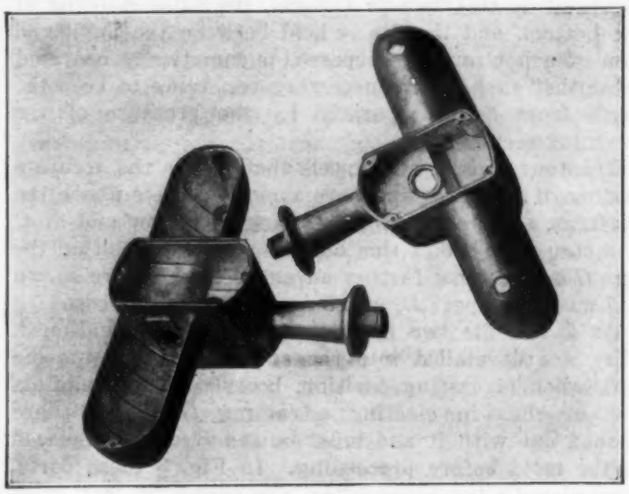


FIG. 1. A DIFFICULT DIE CASTING

and recesses, combine to render the task of design as well as construction anything but an easy one.

As anyone familiar with the art of die-casting need not be told, the difficulty of the process lies not so much in the making of a die that will produce the casting, as in designing it so that the casting may be removed from it without injury. In ordinary foundry practice where the molds are of sand, a mold is made and destroyed for each casting produced. Any shoulder, offset or recess from which the pattern may not be withdrawn without injury to the mold is taken care of by "cores" made up of sand and bonding material, and as many sets of cores are therefore required as there are castings to be made.

When the mold is a steel die, not only must it be so designed that the casting will come out but all cores must be so made that they can be withdrawn before the mold is opened, or must come out with the casting in such shape as to be ready for instant replacement for the next cast.

In the die for making this casting, both parts of which are shown in Fig. 2, there are two loose cores that come out with the casting when the latter is removed from the mold, as well as several others that are so arranged as to be withdrawn from the casting by means of levers and pinions.

The upper faces of the parts, as shown in the illustration, are the mating faces—the parting line—of the mold, and it will be noted that this does not lie in a single plane, but has an offset of about ¾ in. In casting position this face is vertical, the sides *A* being at the bottom, and the die is held between the anvil and ram of a horizontally disposed, pneumatically operated press that supplies the necessary resistance to keep the parts from being separated by the pressure of the incoming metal.

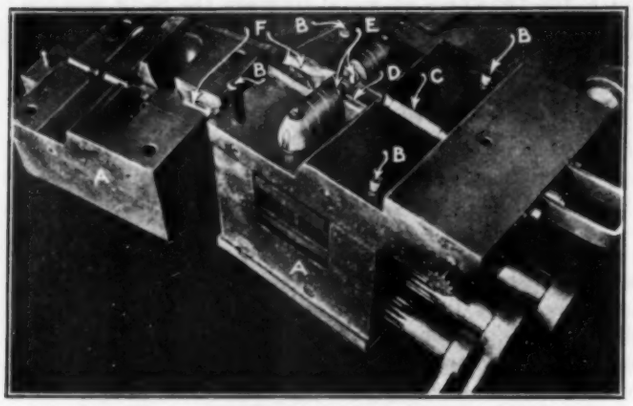


FIG. 2. DIE USED IN PRODUCING CASTING

The four pins *B* are dowels that insure the accurate mating of the dies, and permanently project above the surfaces. The stem of the casting is hollow and at *C* is a core that makes this hole. In casting position the core *C* is somewhat farther advanced than is here shown and meets the part *D*, which is also a movable core

At *E* are the two loose cores previously mentioned. They are dovetailed into the solid portion of the die and, when in casting position, become a portion of its contour, but in ejecting a casting these parts are pushed out with it and must be removed and replaced in the mold before proceeding. In Fig. 3 these parts, marked with the same letter, are shown as they have been set back in the mold but have not been pushed down to place.

In Fig. 3 it will be noted that many small pins that are not visible in Fig. 2 project from the parting surfaces of the die. Some of these are cores for the small screw holes but most of them are ejector pins for pushing the casting out of the mold. All of these pins are operated by the various levers that may be seen in Fig. 2. The ejector pins are, of course, flush with the surface of the die and form a part of it when a cast is made, while the core pins are left projecting to form the holes.

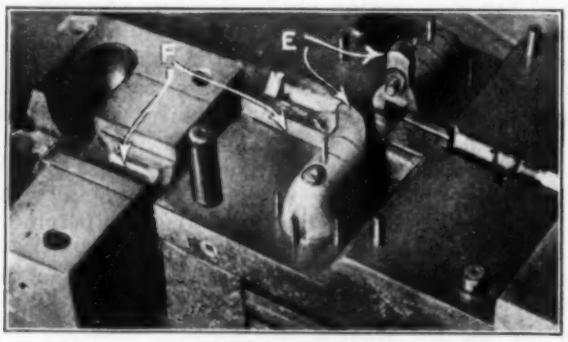


FIG. 3. DETAIL OF THE LOOSE CORE

The openings, marked *F* in both Figs. 2 and 3, together form the sprue through which the molten metal enters the die. When the two parts are together this, at the outer end, is a round hole the entrance to which is beveled or countersunk to match the correspondingly beveled spout of the pump.

The machine that does the casting was developed by the Atlas Die Casting Co. for its own use and cannot, therefore, be described. Suffice it to say that the spout of the pump, which is suspended in the pot of molten metal, is forced against the opening of the sprue and, while firmly clamped in position, air at 200-lb. pressure is admitted to the pump, shooting the molten metal into the die and effectually filling every crevice thereof.

Upon opening the die the first move is to withdraw all the cores by means of their respective levers. The operator then pulls forward the lever connected with the ejector pins, pushing the casting slowly and evenly out of the die. It will be noted in Fig. 3 that there are ejector pins under the loose cores *E*, so that these parts are pushed out with the casting and no strain is imposed upon the latter, which at this stage is very fragile because of its heat.

This die was designed by Nathan Lester, engineer of the Atlas Die Casting Co., as was also the casting machines used by this company.

Literal Obedience

By Robert Grimshaw

In certain classes of work there are reasons why instructions should be obeyed literally; other action would involve fruitless discussion and costly, even fatal delay. Whether all orders shall or shall not be obeyed to the letter; whether as the printer says, one must "follow copy, even if it goes out of the window"; whether, as the common phrase goes, one must "obey orders, even if it breaks owners,"—depends on the class of work, the type and experience of the worker, and the degree of emergency. One thing is certain:—where orders are in writing and are understood, responsibility for any undesirable consequence of following them to the letter is readily placed.

At the same time, if the foreman sees beyond all question that orders sent him are impossible to follow literally, or if so followed would bring about trouble, it is his duty to say so, at once; just as it is the duty of an apothecary who finds an error in a prescription, to communicate at once with the prescribing physician.

Erratum

We hasten to correct an error which appeared on page 688g in our issue of May 4. In the Clipping Index description of the portable automatic punch for hardness testing the word "scleroscope" was used in the title. Our attention has been called by the Shore Instrument and Manufacturing Co. to the fact that "scleroscope" is a registered trademark in the United States Patent Office and cannot be used except in connection with the device made by this firm. We wish to say that the Case Hardening Service Co., of Cleveland, distributor of the punch, is blameless in this matter as the word scleroscope was added to the title of the description through a clerical error in our own office. We shall publish in an early issue a corrected Clipping Index description to supersede the one in the May 4 issue.

The Grinding of Gear Teeth
and Its Future in the Industry

Conclusion—Application of Ground Gear Teeth in the Automotive Industry—Overcoming the Effects of Heat-Treatment—Elimination of Noisy Gearing by Grinding

By R. S. DRUMMOND
Vice-President, Gear Grinding Machine Co.

As a sample of the stock removed from gear teeth by grinding process, figures are given bearing on gears similar to those in automobile transmissions, varying in size from 2 in. in diameter to 8 in., of 6 or 7 pitch, and ⅝ to 1¼-in. face, either casehardened or oil-treated.

On such gears it is usual to correct the tooth curve and give a good finish to the tooth surface by the removal of approximately 0.003 in. from each side of the tooth. Where the inaccuracies of machine work or the distortion of heat-treatment is rather excessive, it sometimes becomes necessary to remove as much as 0.006 in. from the surface of the tooth on both sides. The removal of this amount of stock, 0.003 to 0.006 in., will remove from the thickness of each tooth from 0.006 to 0.012 in., adding that much to backlash in a given gear, or double this amount in a pair of gears meshing together. We find that on the average we can expect the backlash to increase 0.010 to 0.015 in. in commercial transmission gears, due to the removal of stock by the grinding process.

Permissible Backlash

This brings up the important subject of backlash and its effect on gear operation with respect to uniformity of transmission of power and noise. It has been our experience over several years that transmissions are normally helped by increase of backlash—for a long time manufacturers of this product held the backlash so close (0.004 to 0.006 in.) that a serious oil hammer was evident, especially in cold weather. As the backlash increased this disappeared.

In the normal operation of gears 0.022 in. backlash has been found highly satisfactory in high grade transmissions. The only unsatisfactory result of additional backlash comes from the accumulated backlash between a series of gears where the driven member over-runs the driver—as in a car coasting against the engine. This will accumulate the backlash, and cause the gears to tap against one another with a single distinct tap, which is normally not objectionable in automobile transmissions. It is unusual for drivers to continuously surge their cars backward and forward.

Casehardening

The depth of casehardening of such gears, which is usually specified 0.035 in. or more, is amply sufficient to permit of the grinding of gear teeth for salvage purposes, or for finishing gears with grinding stock allowed, without alteration of casehardened limits. A reduction of 0.006 in. from the specified 0.025 in. minimum will still leave ample case. Some manufacturers prefer to make the case 0.040 in. deep and this has proved entirely satisfactory.

Paper presented at Buffalo convention of the American Gear Manufacturers' Association.

In the rapid and economical operation of grinding gear teeth certain machine limits are important. We mention them as follows:

(a) Variations in the bore of the gear may be permitted in automobile transmissions to vary 0.000 to 0.001 in. over specified size.

(b) The hub face may be permitted to run out up to 0.001 in.

(c) Outside diameter may have a run out of 0.005 in. in gears from 2 to 8 in. in diameter.

(d) Index error may be permitted in a rough machine product up to 0.003 in.

Such discrepancies in the rough product are well within ordinary machine limits of machine production without need for special features and accuracy of gear tooth cutting or gear manufacture. The bore and the face of the gear as mentioned are important because it is customary to grind gears in groups of from 1 to 12, according to their size and general proportions.

The limits for grinding stock permit of the elimination of normal errors in run out or index error as mentioned.

Should these errors in run out or indexing or thickness of the tooth be exceeded, it is necessary in finish grinding of the teeth to remove additional material which in turn increases the backlash but otherwise does no harm in transmission gears.

Recommended Grinding Stock

In sleeve gears (main driving pinion and stem gear) it is desirable to fit the sleeve gear with great accuracy into the mating second speed gear with the internal tooth construction. We find on such sleeve gears in the rough the amount of stock desirable is 0.010 to 0.014 in. over desired tooth thickness. This amount of stock permits the grinding of the sleeve gear down to an exact size which will accurately and snugly fit the internal teeth on the second speed clutch connection which is used in direct drive on most cars.

It is usual to leave the teeth of other gears of a normal transmission with 0.006 to 0.012 in. over desired tooth thickness.

These limits of tooth thickness are in common use in the manufacture of several types of transmissions with a backlash in the main driving gears of 0.008 to 0.012 in. backlash and in other gear combinations from 0.012 to 0.020 in. backlash.

In discussing this general subject of removal of stock, it is important to state here that the minimum amount of stock which can be removed is microscopic.

The only tooth form of importance is the pure involute curve. Our experience has proven that the closer the form of the tooth is held to the accurate involute form without modifications the better the gears operate with respect to quiet and accurate operation. Ground gears with proper accurate tooth form will operate

silently unless other features of the construction produce noise.

It is true that certain lengths of tooth and certain involute curves are more particularly suited to a given class of work, as for instance, the development of gear teeth in automobile transmissions has today centered around the use of gears of 6 or 7 pitch and pressure angle of 20 deg. or more. These gears require relief for such interference as occurs from natural abutting of teeth due to the numbers of the teeth in contact. For instance, in 13 teeth running with 14 this abrupt butting of the teeth is due to the number of teeth and is relieved by increasing the pressure angle until the effect disappears. Where this increase in pressure angle is not desired, some transmission cases have been corrected for this defect by the reduction of the outside diameter of the gear tooth to the point which eliminates this interference.

No Universal Tooth Length

There is no one tooth length which is universally correct, although the normal standard full length tooth lends itself best to quiet operation, due to its long period of contact and the fact that one tooth is in full contact when the next tooth following takes hold.

In reading various papers on gearing, one is impressed with the number of times that the theory of action of the true involute is fully described and how little attention is paid to the action of curves which are usual on gear teeth. Examinations of hundreds of lots of gears totaling many thousands, show that the prevalent tooth curves are approximate involutes, but practically never within 0.002 in. of accuracy, unless finished after heat-treatment. As a sample, we would quote one concern whose standards and masters for the last five years have been a misplaced involute located 0.009 in. low on the drive side and 0.005 in. low on the coast.

Teeth accurately formed to the true involute curve will operate accurately and relatively quietly on spread center distance, but in gear cutting it frequently occurs that one of a pair of gears will be off in form and make noise. The action of gears operating with curves placed too high or too low is to cause the gears to move with a speed varying up and down with each tooth action.

Another effect is that the next mating tooth contacts with its mate at a different speed from the mate causing an impact. It is rarely possible to secure double tooth action. This has the effect of giving the full driving force as a wearing pressure on the tooth at the period of greatest sliding action.

Last year we salvaged 50,000 gears for one concern in Detroit. These gears had been previously cut to size and the grinding operation added an average of approximately 0.012 in. backlash, but the gears were quiet after grinding and very noisy before grinding. These gears had improper tooth form when they reached us and we simply ground down the surface of the tooth to a true curve and the gears became quiet. In another instance we ground for an automobile manufacturer during a three months period 35,000 gears which had been put on the shelf during the previous two years as rejected and scrap parts. These gears formerly passed the ordinary inspection as to size and appearance and rolled fairly well, but they were noisy when assembled into transmissions.

The most common error causing gear noise is the misplacing of curves so that after each tooth contact the mating gear is accelerated or retarded abruptly.

Irregular surface contact due to bad shape of the curve applied. This frequently causes the oil film between the teeth to be broken down, giving a metal to metal contact which is noisy.

Improper inspection of cutters or hobbs used in finish cutting gears. It is safe to estimate that 25 per cent of the cutters and hobbs offered on the market are sufficiently inaccurate to cause gear noise unless some master adjustment is made on the machine to modify their effect. When one considers the large number of rejected cutters it is uncomfortable to consider what becomes of these parts which are returned to the manufacturer.

The usual practice of locating the bore of the gear by use of pins between the teeth when the gear is required to operate on a splined shaft causes noise. The object of the number of pins between the teeth is to centralize the bore with the distorted or misformed teeth and at its best this practice only divides the error which is present in the teeth held by the pins. This method does not eliminate the error; it simply divides it. In gear grinding practice it is recommended that the gears be central from splined grooves when the bore is ground. This centralizes the bore with the splined grooves, the gear is then mounted on this ground bore and the error is removed from the teeth so that all three parts are centralized, the gear teeth, the bore and the splined grooves.

The fit of the main driving pinion into the second speed gear is another cause. This causes a very distasteful rattle when the fit is not accurately made. In gear grinding practice it is easy to grind the driving pinion to size not only within the proper limits, but so that it makes a close fit in the space provided in the second speed gear.

Undue stubbing of teeth is another frequent cause for noise. This arises from the adoption of a stub design because it is easy to say "stub," rather than because this combination of length or pitch is a good design. In a recent job handled by us stub teeth were recommended and used by a manufacturer where the shafts were normally spread up to 0.015 in. and the gears were made with a normal amount of undersize on the O. D. and normal amount of eccentricity. Although these conditions were known, the manufacturer supplied these stub teeth and a totally unsatisfactory job resulted. The teeth would not carry over properly from one to the next, there being bearing on the end of the receding tooth of only about 0.008 in. from the top when the next tooth came in contact.

Indicating Tooth Length

There would appear to be no reasonable basis for the present general practice of labeling 6-8, 7-9, etc. as the length of the teeth so indicated are not proportioned to one another. The ratio 6-8 being equal to 0.75 and the ratio 7-9 being equal to 0.77, etc. It is disastrous to design gear teeth so that one loses its load or takes it up before the other is in full contact, and by full contact we mean more than just edge contact on the end of the tooth.

Gear teeth must not only be long enough to reach from one tooth to the next, but for normal quiet operation they should be enough longer so that the next tooth following will reach a full satisfactory contact

before the receding tooth leaves contact. This must also be effective under normal errors in machining such as run outs, index error, undersize condition, etc.

Under certain conditions stub teeth can be produced faster than long ones. This may recommend the machines but it does not necessarily recommend stub teeth. We find the tendency of the market away from this design and transmission builders today are looking with favor on longer teeth and finding that the cost of manufacture is not necessarily greater when conditions of trouble and noise are taken into account. The full tooth gives ordinarily a longer period of contact and lends itself to an easier, less abrupt contact and an easier, less abrupt leaving of contact.

Another feature of design causing trouble is pressure angle. Our forefathers selected 14½-deg. pressure angle just as years ago they selected window glass 6 x 8 in. in size; we followed that practice for years afraid to change—some are doing it yet. All theory and practice point toward improved operation of gears when made with sufficient pressure angle. It is practical to recommend a pressure angle of sufficient degree to avoid modifications of tooth for natural interference. In most transmissions today 20-deg. pressure angle is adopted practice; in some we have used 22½, 24 and 27 deg. The so-called excessive pressure on bearings has not been proved to be an objectionable feature in automobile high speed transmission gears. The mating up of gears of 14½-deg. pressure angle in combinations approximating 14 teeth requires an extreme accuracy out of all proportion when it is considered how easy it is to make the same gears with a larger pressure angle.

Perhaps the chief causes of gear noise in transmissions lies in distortion due to heat-treatment. The cost of distorted gear teeth in rejected gears and tearing down transmissions is so great that it is fair to assume that the cost entailed in grinding the parts accurately after heat-treatment will not exceed the cost of rejections and troubles.

Cost of Gear Grinding

It has been proved that where accuracy or silence of operation are important factors in the gear product, the finish grinding of the gears after rough machining is more economical than the finish cutting of the gears.

The average cost as furnished by several manufacturers for tearing down and changing gears in transmission is $3 per transmission. The average cost as furnished by several car builders for tearing a transmission out of an assembled car entailing the removal of the car from production assembly, is $15 per car. The average cost of changing the idler gear where a cap is provided on the side is about 50 cents per gear.

Recently in an automobile shop the number of tear-downs of closed car transmissions exceeded sixty per day. In another shop recently the tear-downs involved 50 per cent of all transmission assembled. When gears are being produced in quantities exceeding 1,000 pieces of a kind per month, the finishing by the grinding process is in itself less than the cost of finishing by the cutting process.

In computing the item of cost, it is well to take into account the high cost of finish cutting of gear teeth. All the operations on the gear blank up to the finish cutting can be performed as machine shop operations, not as gear cutting, and it should be properly charged with machine shop overhead, not gear department overhead. Limits of accuracy on the gear teeth when prepared for grinding allow a leeway on the thickness on the tooth as much as 0.005 in.

The roughing operation can be performed at the maximum speed of the cutter and the machine, not as a slowed-up operation. There is no rolling of the gears, no remating of the gears; no rejection for runouts; no rejection for bad curve position, no rejection for index error; no rejection from running gears in power test; no cost of running in gears; no excessive cost of tearing out transmissions are involved when the gears are ground. The production of rough gear blanks finished on the bore and face is a machine operation with machine shop overhead, at least 150 per cent less in cost than gear department overhead.

You should realize further that the scrap gears which are accumulated in the gear shop are largely accumulated after finish cutting. The normal scrap loss in the gear grinding process does not equal 1 per cent.

Wear of Gear Teeth

It is quite improbable that you would accept bearings and shafts, the surfaces of which were as rough as the ordinary gear tooth. You realize that such uneven surfaces would begin at once to wear down the bearings. A recent article on the subject of gear tooth wear by E. R. Ross showed how it began at or near the pitch line, and how it progressed along the gear tooth, spoiling more and more of the surface of the tooth exactly as a rough shaft wears a bearing.

A great deal has been said on the subject of modifying the wear by the use of special steels and very little has been said of eliminating the wear by providing an accurate surface which will tend to avoid the beginning of wear. The ground surface on a tooth lends itself to the avoidance of tooth wear in exactly the same relation and exactly the same extent that a ground bearing on a shaft avoids the beginning of wear.

We have referred to the roughness of the tooth puncturing the oil film. In this connection you will realize that no wear can begin until the oil film between the parts has been punctured or squeezed out. Rough tooth surface punctures the oil between the teeth and starts the wear; also misplaced curves cause abrupt, sharp contacts between the teeth which will puncture the oil film and cause wear. The average surface condition of heat-treated gears would be rejected at sight for any use in a running bearing. When properly designed and made, gear teeth slide and roll on a film of oil with no more wear than is present in a shaft accurately made and operated under well lubricated conditions.

Can you imagine a manufacturer assembling any other power transmission bearing by rubbing it against its bearing with his eyes shut and determining totally by the touch of the finished product whether the parts are mated sufficiently close to operate quietly and without wear? Many times we have heard complimentary remarks about the "appearance of the tooth surface," just as if it were a miracle that it ever looked smooth.

We frequently hear of machine tools with wear on the gear tooth which causes inaccuracy of operation. We expect a big advance in the manufacture of machine tool gears by the introduction of hardening and grinding on these parts. Experience has proved that such gears can be made with great accuracy so that they will operate quietly and without the ordinary well known wear.

Automotive Service Methods and Equipment

X. Home-made Tools for Repairing Ford Cars—A Simple Method of Holding Transmissions for Repairing—A Safety Device—Other Tools

By HOWARD CAMPBELL
Western Editor, AMERICAN MACHINIST

MODERN business has come to depend so much on the telephone as a means of communication that any disruption of the telephone service is considered almost in the light of a catastrophe. Thus it is that immediate and sure transportation of men and materials is a necessity, for which the service station is largely responsible.

The Chicago service plant of the Illinois Bell Telephone Co. includes among its equipment a number of tools and devices that have been developed and made in the plant. One of these is the connecting-rod reaming jig shown in Fig. 1. The base *A* is a solid block of steel, to which the collar *B* is fastened with dowel pins and screws. A small block through which a hole is bored to serve as a guide for the reamer is clamped over the large end of the reamer as shown. A movable block *C* holds the pin *D*, which fits the piston-pin hole in the rod and serves to maintain the center distances between the large and small holes. The block *C* can be moved to accommodate the various sizes of connecting rods.

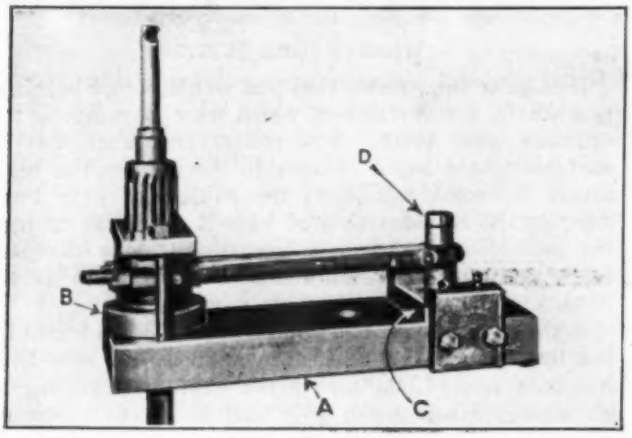


FIG. 1. A SIMPLE CONNECTING-ROD REAMING FIXTURE

A tool for removing and replacing bushings in Ford pistons is shown in Fig. 2. The piston rests in the V in the block, and the screws shown at either side are screwed against the sides of the piston to prevent expansion while the old bushings are being removed. The lower part of the pin *A* passes through the bushing to serve as a guide, while the upper part is of the same dimension as the o.d. of the bushing. This pin is used both for removing and replacing.

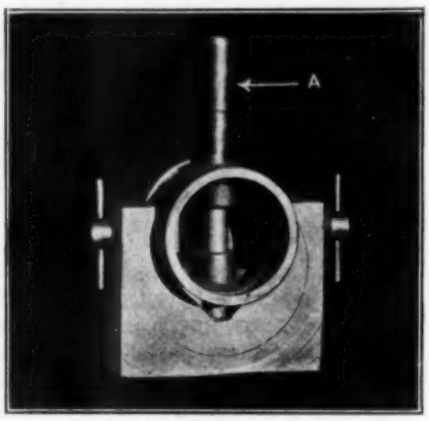


FIG. 2. JIG FOR REMOVING AND REPLACING BUSHINGS

Tools for removing, facing and replacing Ford drive shaft tube bushings are shown in Fig. 3. Tool *A*, only part of which shows in the picture, is turned to a diameter that will allow it to pass through the bushing in the upper end of the drive shaft until the thread is reached.

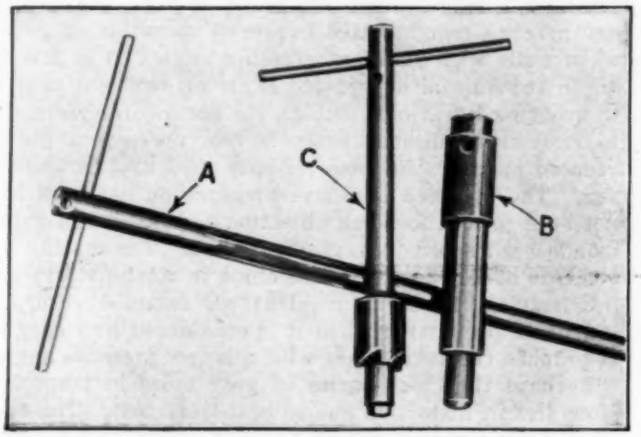


FIG. 3. TOOLS FOR REMOVING, REPLACING AND FACING FORD DRIVE SHAFT BUSHINGS

The thread is screwed into the bushing until it is quite solid, then the rod and bushing can be driven out of the tube from the opposite end. The tool is 66½ in. long and the thread is eight to the inch, the o.d. at the threaded portion being one inch.

After the old bushing has been removed, the new bushing is put on the small end of tool *B*, and is pressed or driven into place. The small ends of both tools *B* and *C* are turned to sliding fits in the bushing. When the bushing is in place, the tool shown at *C* is used to face off the end of the bushing to allow clearance for installing the universal joint.

Practically every repair man knows how difficult it is to hold a transmission while assembling or repairing it. The sketch, Fig. 4, shows a very simple fixture to which the case can be bolted while it is being worked on. The piece is bolted to the bench through the ½-in. holes in the flat part at the right-hand end, and the transmission case is bolted to the circular part. It is only necessary to use three or four bolts to hold the case, and several sets of holes can be drilled in the fixture, so that it will accommodate several different kinds or makes of cases. The case can be used as a templet in laying out the holes. The piece is of ½ x 3-in. steel, and can be forged to shape in a few minutes. It needs no machining other than the drilling.

We don't see as many broken arms resulting from cranking a car with the spark too far advanced as we used to, but it still happens that a man gets hurt now and then. In Fig. 5 is shown a safety device for Fords, by which the possibility of advancing the spark beyond

the safety point is precluded. The device itself is shown in Fig. 6. It consists of a piece of ⅛-in. sheet steel cut and bent to the shape shown, and attached to the commutator by means of a capscrew and a small machine or stove bolt and nut. The end which slips over the

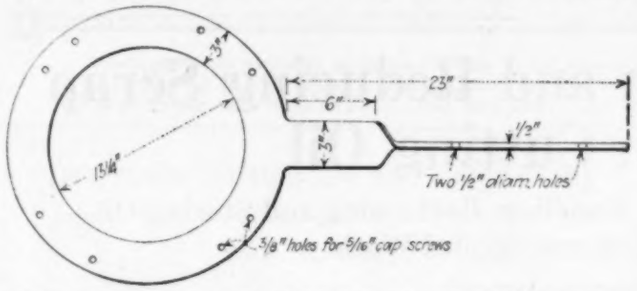


FIG. 4. FIXTURE FOR HOLDING TRANSMISSION CASES

small bolt is slotted, as shown, so that the device can be adjusted up or down. The device covers the depression in the end of the commutator case, but a similar depression can be drilled in the head of the capscrew, which takes care of that feature.

When the spark lever is advanced, the commutator case turns so as to lower the blade of the safety device,

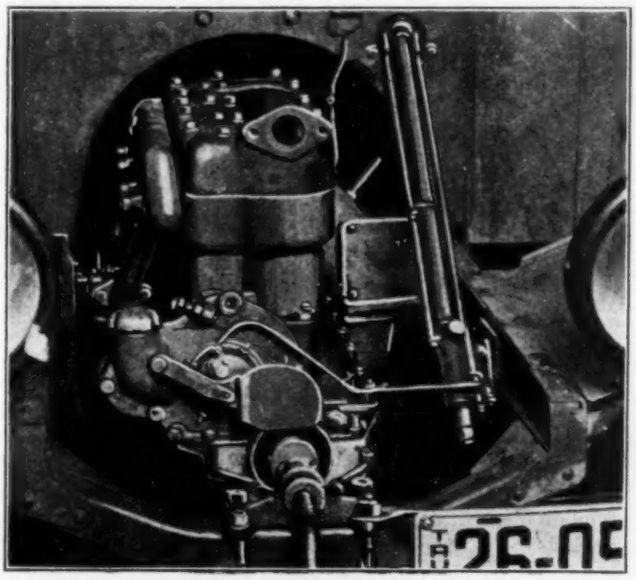


FIG. 5. SAFETY DEVICE ON FORD MOTOR

and when the spark lever is advanced past the point of safety, the blade is down low enough so that the starting crank cannot be engaged with the crankshaft.

A glance at Fig. 7 will show an extra bar extending from one end of the rear spring to the other, and apparently resting on the drive gear housing. This bar is made of ¼ x 3-in. steel, ground off at a 45-deg. angle at each end so that it will fit into the curve formed by the end of the spring. This bar holds the spring in position while the

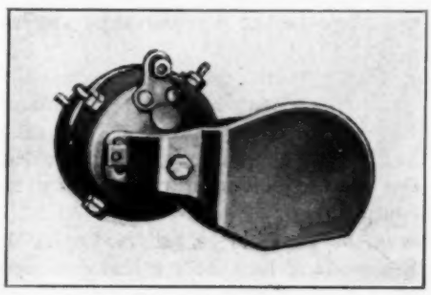


FIG. 6. VIEW OF SAFETY DEVICE

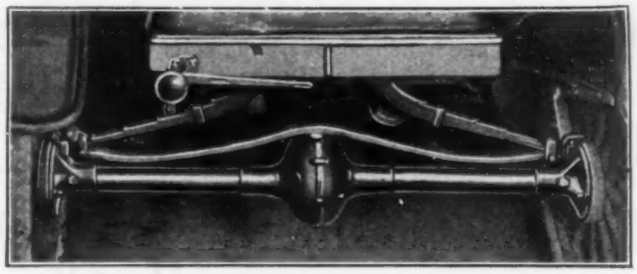


FIG. 7. BAR HOLDING FORD SPRING IN PLACE

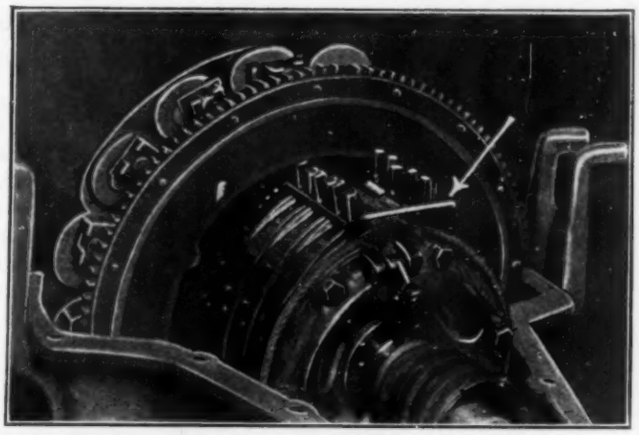


FIG. 8. HOLDING FORD TRANSMISSION BANDS WHILE INSERTING BOLTS

repair man is changing rear axles or spring shackles, or while doing other similar jobs. It should be just long enough so that it will slip in between the spring-eyes easily.

A very simple but time-saving contrivance is indicated by the arrow in Fig. 8. This is nothing more nor less than a piece of wire ⅛ in. in diameter, bent to a letter "U" and offset at the closed end as shown, and is used to hold Ford transmission bands in place until the bolts can

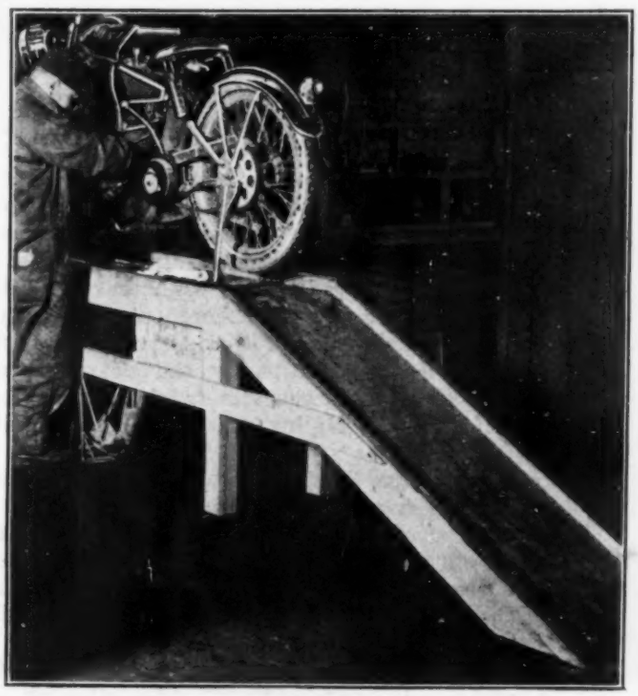


FIG. 9. MOTORCYCLE REPAIR STAND

be inserted, relieving the operator of trying to hold the bands with one hand and insert the bolts with the other.

The dimension between the two legs of the "U" is 2½ in. and the length from the open end to the closed end is 5 in.

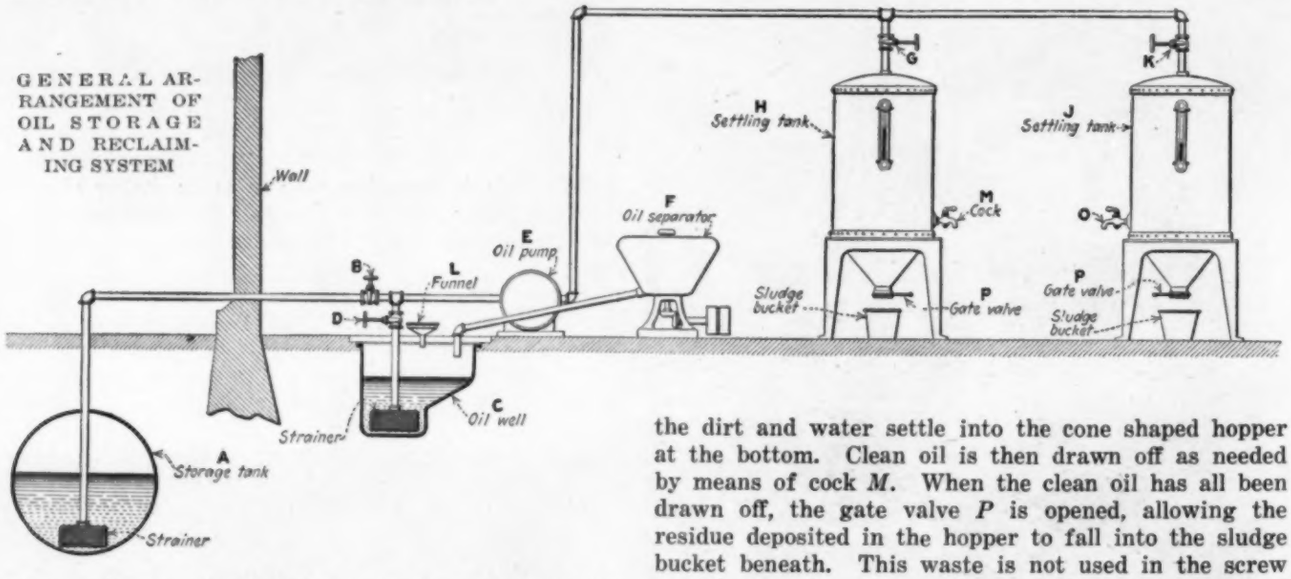
As this company uses a number of motorcycles for getting to the smaller "hurry-up" jobs, it became necessary to erect the stand shown in Fig. 9 so that repairs could be made quickly and easily. The picture tells the story

Increasing Production and Reducing Scrap with Clean Cutting Oil

An Efficient and Easily Built Plant for Handling, Reclaiming and Storing Oil—Its Effect on Production and Spoiled Work

SPECIAL CORRESPONDENCE

THE oil storage system herein described was designed to take care of cutting oil used in the screw machine department of a large automobile shop. Before this system was installed, the practice had been to allow the machines to run with the same oil until it was considered too dirty for further use. The machines were then cleaned out, the used oil thrown away, and new oil furnished to each machine in the department.



It was soon noticed that a large increase in production was made each time the oil was renewed, and as the quality of the oil went down, there was also a corresponding drop in production, an increase in the amount of scrap, and the tools wore out much more rapidly. This clearly showed that a very important relation exists between the purity and cleanliness of the cutting oil, and the production from the machines. The need of an oil purifying system was thus made evident.

The storage system illustrated was then installed and gave very gratifying results from the beginning.

The general arrangement shows the oil separator at *F*, the oil well at *C*, where the impure oil is collected both from the separator and by pouring through funnel *L*. The main underground storage is at *A* while the two setting tanks are at *H* and *J*.

Just as soon as the oil in the machines begins to lose its efficiency it is pumped out by the oil pump on the machine. The muddy oil and residue, which the machine pump will not remove, is cleaned out and discarded.

The used oil is poured into oil well *C* through funnel *L*. From the oil well it is pumped to one of the settling tanks *H* and clean oil taken from the other tank *J* is supplied to the machines.

The used oil is allowed to stand in the tank *H* until the dirt and water settle into the cone shaped hopper at the bottom. Clean oil is then drawn off as needed by means of cock *M*. When the clean oil has all been drawn off, the gate valve *P* is opened, allowing the residue deposited in the hopper to fall into the sludge bucket beneath. This waste is not used in the screw machines again. It may be used for oiling the road or similar purposes.

The oil from the separator *F* is also piped to the oilwell *C* and receives the same treatment as the oil taken directly from the machines. The flow of oil to the settling tanks is controlled by proper manipulation of the valves *G* and *K*.

The supply of oil is replenished as needed from the outside storage tank *A*. By closing the valve *D* and opening the valve *B* the oil can be drawn from the storage tank and delivered to the settling tanks by the pump *E*.

Before installing this system, oil was purchased in barrels and there was considerable oil lost by leakage and careless handling. The storage tank *A* was made of such capacity that it was possible to buy the cutting oil in bulk, and the waste incidental to handling the oil in barrels was eliminated.

It would, of course, be possible to purify the oil by the use of a filtering system, but the method described above is much quicker, and in practice, has proved very satisfactory.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Device for Setting Up and Laying Out Templets

BY S. H. DRAKE

An angle plate, designed for use in connection with the laying out of a large amount of templet work on which the reading of a good protractor was sufficiently accurate, is shown in the accompanying illustrations. It has a number of advantages over the ordinary angle plate, not the least of which is that it is not necessary to machine a straight edge on the work in order to get an accurate angular setting.

It is possible with this device to lay out centers at points on a line at any angle to a given center line by means of a height gage, and the setting from one position or angle to another is very quickly accomplished.

In Fig. 1, *A* is a regular angle plate of cast iron mounted upon four legs of sufficient height to allow the auxiliary plate *B* to swing. Tapped holes in the latter plate furnish convenient means of attaching work.

At the center of the auxiliary plate is a fixed stud projecting through, and having a bearing in, the main plate. Upon this stud, back of the main plate, is keyed the disk *C*, which is graduated in degrees over the full circle and provided with a vernier *D* from which a reading to five minutes of arc is readily obtainable.

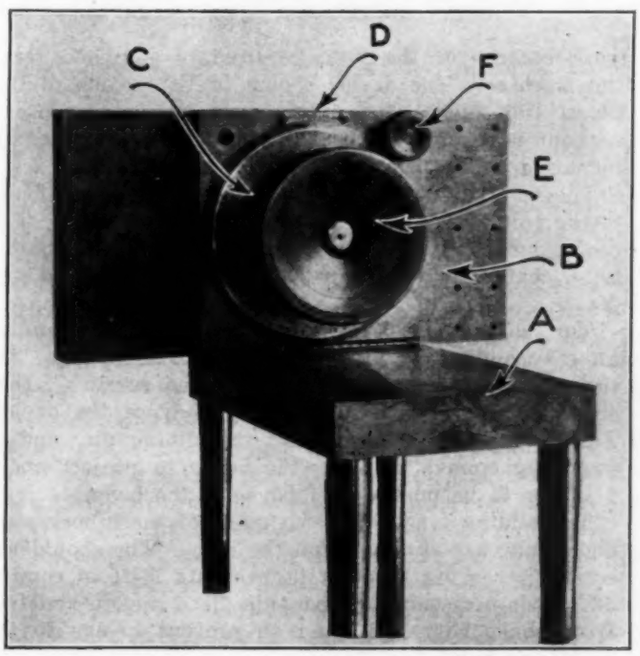


FIG. 1. REAR VIEW OF DEVICE, SHOWING GRADUATED DIAL

The large knurled nut *E*, threaded to the stud, serves to clamp the plate firmly in any position. A tapered locking pin *F*, passing through the main plate and entering correspondingly tapered holes in the auxiliary plate at the four major positions and also at angles of 30, 45 and 60 deg., provides means of setting the device quickly to these positions. Other angles are determined from the dial readings.

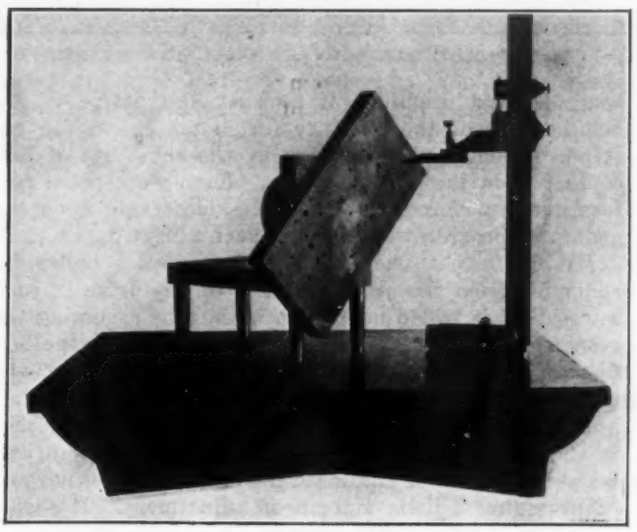


FIG. 2. FRONT VIEW SHOWING HOW DEVICE IS USED

In Fig. 2 the face of the device is shown with the auxiliary plate set to an angle of 45 degrees.

Keeping a Belt Tight

BY J. T. TOWLSON

The interesting article under the above title, published on page 227 of AMERICAN MACHINIST, was not intended, I hope, to instruct the readers as to how a belt should be kept tight. When any belt drive is in need of such a belt destroying device as the one mentioned in that article would seem to be, it is high time for the boss to look around for some other means of driving.

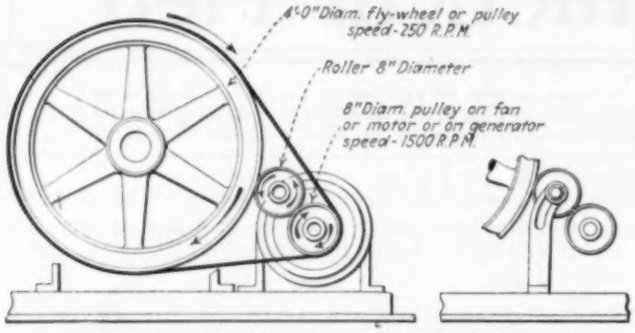
The method defeats the purpose it is intended to effect for the reason that the continual rolling of the pulley on the outside of the belt tends not only to lengthen the latter but to destroy its flexibility, and when that is done the desired result of non-slip drive is more remote than in the beginning.

Correct diameters of pulleys, proper center distances, and a reasonably tight belt of ample width are, in the writer's opinion, far more to be desired than any of the belt-tightening contraptions in use.

Mr. Raworth, sometime editor of *The Engineer*, designed a simple and (then) novel application of a short belt where one pulley is very small and the other relatively large; as, for instance, a low speed engine driving a fan or dynamo, or when a slow moving machine is to be driven direct by a motor.

Referring to the illustration we have, let us say, a

gas engine with a 4-ft. flywheel running 250 r.p.m. belted direct to a generator that has no outboard bearing. Though this is a very convenient set-up where



AN INTERMEDIARY PULLEY ON A SHORT DRIVE

space is at a premium, it is most destructive to the belt because of the short center distance and the extreme tension made necessary by the short arc of belt contact upon the smaller pulley. Even were these factors not considered, the excessive side strain upon the generator bearing would render such a drive impractical.

Mr. Raworth's scheme was to interpose a pulley, or roller, between the main members of the drive in such a way that it would bear upon both, thus assuming the responsibility of carrying the load imposed by the belt tension, no matter how great the latter might be, and relieving the side strain upon the generator bearing.

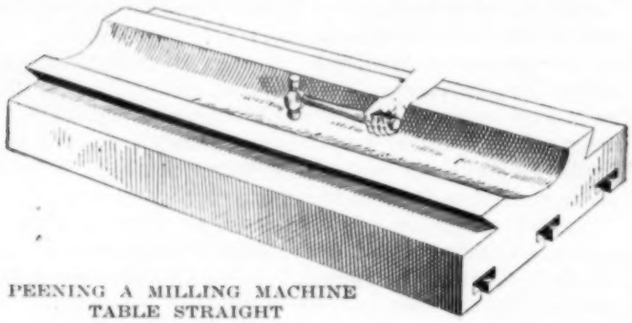
It will be noted that the intermediary pulley is placed in such a position as to be slightly above a line drawn between centers of the main members, for the purpose of providing a little margin of adjustment. It should be mounted upon ball bearings.

Having used this method on several occasions where the necessity for a close-up drive existed and finding it most serviceable and efficient I can recommend it for all similar drives.

Straightening a Milling Machine Table

BY A. W. FREEMAN

It has been my experience to find that the tables of milling machines become warped after years of service under average conditions, because of the peening effect of the numberless small dents in the upper surface. Some years ago I had occasion to repair a table that was thus warped, the surface showing a comparatively



PEENING A MILLING MACHINE TABLE STRAIGHT

uniform curve from end to end and being about $\frac{1}{16}$ in. high midway of its length.

We put this table on a planer and took off just enough stock to clean up, and then scraped the table and saddle together. When the fitting was complete we found that the table set $\frac{1}{32}$ in. lower in the saddle than before so we were obliged to elongate the holes in the end plates, or screw hangers, in order to bring the screw in line.

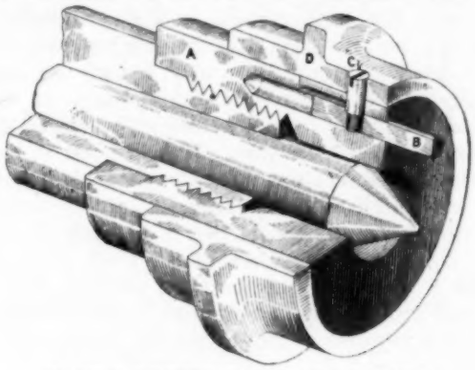
Having a similar repair to make recently, we profited by our earlier experiences and instead of planing the table straight we peened the under surface between the V's and straightened the table as shown in the sketch before any planing was done. This we accomplished in about ten minutes with an ordinary ball-peen hammer, keeping track of the progress by means of a straight-edge and feeler gages.

After the table was straightened in this manner we took off about 0.005 in. from the upper surface to make it smooth, and the job was done. There was no necessity for rescraping the bearing surfaces or readjusting the screw hangers for the reason that practically no stock had been removed and the table was in its original condition.

A Convenient Driver for the Lathe

BY C. E. STEVENS

In operations in which parts are to be turned on centers or on arbors that are held between centers, considerable time is lost in removing and replacing the



HANDY DRIVER FOR LATHE WORK

work because of the time required to stop and start the machine. The device shown in the accompanying illustration allows the operator to change his work without reaching for the shipper, and has resulted in increased production.

The body *A* is made of machine steel and is fitted to the spindle nose of the lathe in the usual way. The center hole in *A* is large enough to clear the regular lathe center, which projects about $\frac{1}{2}$ in. beyond the device.

The driving pin *B* is made of $\frac{3}{8}$-in. drill rod and is an easy sliding fit in the body. It has a $\frac{1}{4}$-in., 24-thread tapped hole for the shouldered screw *C*, that slides in an elongated slot in the body of the device. This slot is milled parallel to the sliding pin, and is just long enough to allow the latter to project about $\frac{3}{8}$ in., or to be pushed in flush with the body.

The sliding ring *D* is also made of machinery steel and is an easy sliding fit on the body. The shouldered screw *C*, passing through it, prevents it from coming off. It is necessary to have this piece smooth and free from sharp edges in order to prevent injury to the operator's hands.

With this device the operator simply pushes back the sleeve, and with it the driving pin, when he wishes to remove the arbor or work from the centers. When it is again in place the sleeve is pushed out and the pin engages the tail of the dog.

What Is the Best Way to Show Sections Through Ribs?

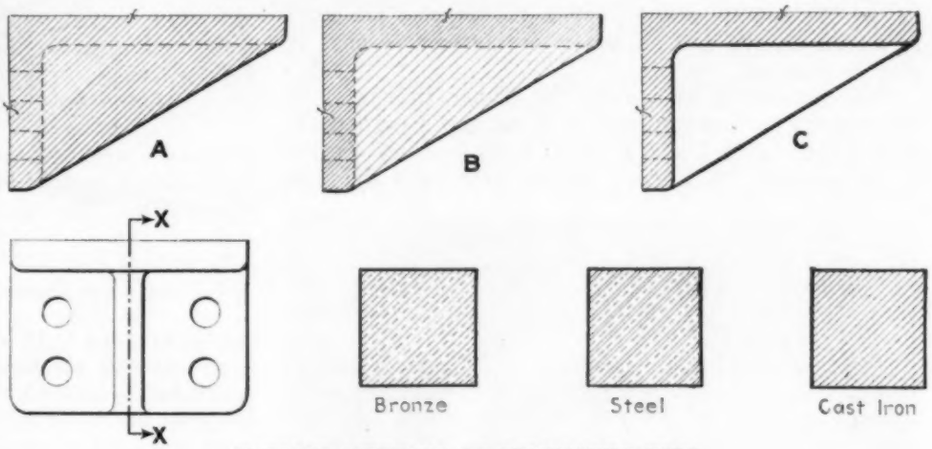
By Aloysius Wilks

Away back in 1915 the late Prof. John E. Sweet started in American Machinist (Vol. 43, page 936) a series of articles or discussions on the "Best Way to Do Certain Things."

The response was not what it should have been. The lack of interest displayed was due, no doubt, to the rush of business in connection with the war then in progress, and everyone was forced to be content with just doing things—without worrying himself much about whether or not he was doing them in the best possible way.

Times and conditions have changed indeed, but the spirit of conservation of material and energy engendered by that trying period still prevails, and its influence is shown in the existence and work of various bodies and committees of standardization. The writer is, therefore, of the opinion that the revival of Prof. Sweet's series would be timely, and to start the exchange of ideas he is submitting for discussion the best way of presenting the cross-section of ribs, spokes, etc., where such are to be shown on drawings.

During the war period I had charge of a class of foreign-born workers to the members of which I was trying to impart a knowledge of the art of reading mechanical drawings. Studying several books upon the subject in the endeavor to establish the best line of attack, I found that most authorities gave three ways of showing cross-section through ribs, as displayed in the illustration herewith, which shows a section taken on the line *x x* of a shelf bracket.



VARIOUS METHODS OF SECTIONING RIBS

At *A* is the oldest, orthodox and theoretically correct way; something that the up-to-date drafting-room novice might call "according to Hoyle." Notwithstanding the backing of antiquity this method presents serious objections by reason of giving a deceptive appearance of solidity. To remedy this defect, some teachers recommend omitting each alternate line of the section over the rib area, as at *B*; the less dense hatching calling the reader's attention at once to the fact that he has to do with a section through a rib and not with solid material.

This method seems to be much in favor of instructors of mechanical drawing and the majority of students fresh from the schools are familiar with it, but the writer gave it a fair trial and found it wanting. If cast iron were the only material to be designated on drawings this method would serve the purpose, but when we come to adapt the same scheme to the standard sections for steel, bronze, aluminum, etc., we get some very funny results.

I am, therefore, forced to the conclusion that the method shown at *C* is the best; do not cut the rib. It is not exactly or theoretically correct, but may be excused for the same reasons as not cutting through shafts, keys, pins, bolts, and similar parts when there is nothing to be gained by cutting them.

As we have so many conventions in our art, why not add one more? Besides, if you want to keep in the good graces of the efficiency expert, use this method and "slip one over" on old Father Time.

How Can Hindley Gearing Be Gaged?

By Andrew J. Schwartz

The article entitled "Notes on Worm-Thread Formulas" by P. A. Fredericks on page 1043, Vol. 55, of American Machinist, I have found very interesting, and following out the suggestions, I have noted the formulas in my handbook, with reference to the helix angle, limiting it to 3 deg. These formulas, however, apply to straight worm thread; but what about a system for measuring the threads on a so-called Hindley worm? I repeat the appeal of Mr. Fredericks, and solicit the confidence of the makers of the Hindley gearing, to let us know how to measure, or rather how to gage with go and no-go gages the Hindley gears and worms.

It has been suggested that the only way to gage a Hindley worm is to test it against a master gear, and to test the gear against a master worm. By this system it is possible to tell whether or not a gear is perfect and if it will run satisfactorily. But if the gearing is not perfect, this system will not tell the workman how and where to correct the faults, and guesses are often made that result sometimes in ruined work.

Incidently, I have been unable to find a statement of any good points for the use of Hindley gearing, but in numerous books reasons are given why it is not superior to the straight worm gearing. Some of the reasons for not using this class of gearing are:

Its efficiency is no better than that of a straight worm. Hindley gearing is harder to assemble and to adjust, since the worm must be located exactly in three planes.

The worm cannot be ground by mechanical devices on any of its working surfaces.

The hob is expensive as it is difficult to make and cannot be ground.

The worm cut for a given number of teeth in a wheel cannot be used with a wheel of a different number of teeth, although both have the same pitch.

One of the points given in its favor is its superior strength, but a light analysis will show that Hindley gearing is very deceiving in regard to strength. The

threads on the worm do not entirely fill the thread space on the gear, but only a small portion of the threads are in contact. This statement is the result of observations made after blueing a worm and running it in contact with the gear. From these observations it would seem that there is greater strength in a straight worm gearing than in the Hindley type.

The foregoing is getting away from the original subject, but the designing, dimensioning (including tolerances), and the gaging of this type of gearing are very much related. Any information in favor of the Hindley gearing and the methods followed in manufacture and gaging will be greatly appreciated by a large manufacturing plant.

Two Unusual Planer Jobs

BY N. L. POLLARD

We recently had two rather difficult planer jobs to do and we accomplished them with the devices shown. The castings are cutter-heads for suction dredges used in the Williamette and Columbia Rivers, and are used to loosen up the soil on the river bottoms so that it may be pumped.

The cutter-head shown on the planer in Fig. 1 is about 6 ft. in diameter and of about the same length, with a taper hole 6 x 7 x 14 in. located nearly central in the casting. A keyway 2½ in. long by 1 in. deep

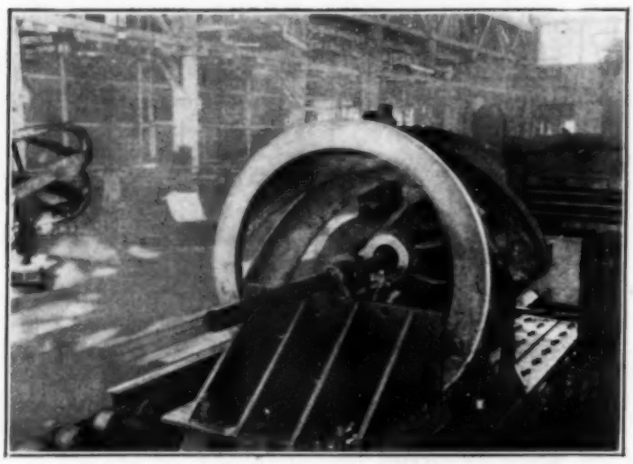


FIG. 1. SET UP FOR PLANING KEYWAYS

had to be cut in this hole. Owing to its location it could not be cut on the keyseater, so by rigging a bar with a bearing clamped to the angle plate as shown, and feeding the tool by tapping it with a hammer, a very good keyseat was planed. Two cuts were taken with a narrow tool and then finished with a tool of the proper width.

The other cutter head, a part of which may be seen in

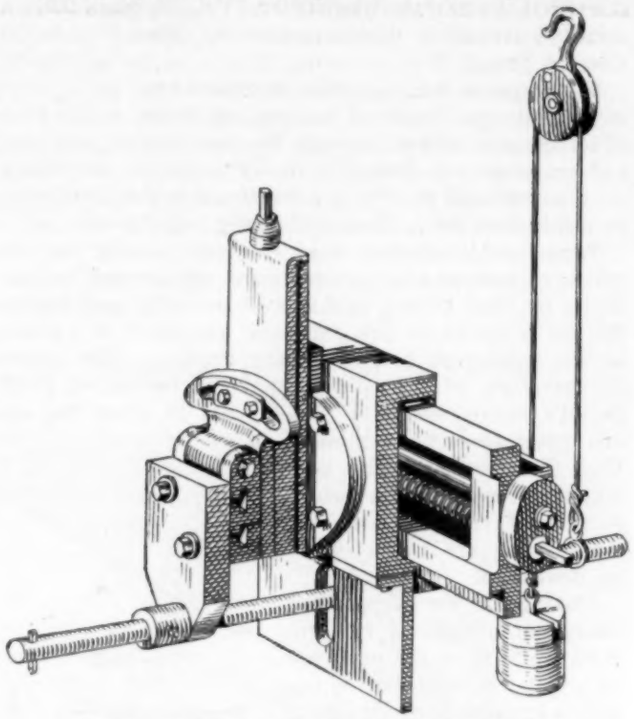


FIG. 2. PLANING A TAPERED SQUARE HOLE

the background at the left in Fig. 1 was larger than the one previously mentioned and had a square tapered hole which had to be machined to 9 x 11 x 18 in. in length, as the head was to be held on its shaft by a draw key. The work was done in a reasonable time by rigging a special tool carrying bar as shown in Fig. 2. The guiding plate was made of 1-in. boiler plate with the slot milled to a nice fit on the bar, and held to the bottom of the planer head by capscrews. The tool was held to the cut by a counterweight hung in the rear of the planer rail.

The hole was first bored to the diameter for about ½ in. on each end to locate it with reference to the other machining operations. Four set-ups were necessary in forming the square; but by planing down the side and across the bottom as far as possible the greater part of the hole was finished in two set-ups, leaving but a small amount in two corners so that the last two set-ups were easy.

Editorial

"They" and "We"

IN DISCUSSING the relation of sales management to industrial engineering at the convention of the Society of Industrial Engineers in Detroit recently, Norval A. Hawkins brought out a point that is as valuable as it is simple and concise. He said that when the salesman refers to the firm that employs him, he always says "we," while the average workman refers to his employers as "they," and that when the employers get that defiant "they" changed to a co-operative "we," better results will be obtained both as to quality and quantity of product, and the differences between the employer and employee will begin to fade. Mr. Hawkins also said that in the institutions with which he has been connected, he has always tried to make the commonest laborer feel that he (the laborer) is a salesman, and that the success of the institution depends just as much on him as on the salesman who delivers the finished article to the ultimate consumer.

A world of thought is contained in Mr. Hawkin's remarks. The difference between "we" and "they" is the difference between co-operation and indifference, and even, in some cases, antagonism. When the employee is brought to realize that his own job, as well as everybody else's from the general manager down, depends on the success of the firm; when he is satisfied that his working conditions have been improved as far as possible; when he is convinced that the firm is paying him the highest wages that will allow a fair margin of profit; when he has been shown that every man who has any part in the manufacture of the product is a salesman, because future sales depend largely on the quality of the work that passes through his hands; when he has learned that he is getting his share of the profits just as surely as any stockholder or officer of the company—then he will discard the "they" when referring to the company or its product and say "we."

Those who are wise will lose no time in doing what they can to hasten the coming of such a day in industry.

Time To Amend

IF ANY further evidence were necessary to prove the need for amendment of the Sherman Anti-Trust Law the present deadlock in the coal situation should supply it. As pointed out in the AMERICAN MACHINIST several weeks ago, one of the decisive factors in the dispute between the coal operators and the miners is the list of indictments hanging over them for violation of the Sherman Law at the time the last wage agreement was negotiated.

The assurances that the operators could meet with the miners' leaders without fear of prosecution were quickly withdrawn after the Attorney-General's visit to Judge Anderson. It is understood that the Justice very properly pointed out that it is not within his power to change the law, and that under the terms of the law as it stands, the representatives of both operators and miners would be liable if they got together to make an agreement. If we admit that a wage agreement is desirable in the coal industry it would certainly appear that some steps should be taken by our lawmakers to permit such an agreement to be arrived at legally.

We have seen the evil effect of the strict interpretation of this somewhat ambiguous law on trade associations. Unfortunately, it seems to hit the good ones as often as the bad ones and gives rise to a feeling of uncertainty as to what can be done legally and what cannot, that is disconcerting to say the least.

Combination in business is not the unmixed evil that certain reformers would have it. It may be abused and result in injury to the community just as other things not inherently bad or dangerous may be made so through abuse. In foreign trade we have the anomalous situation of a government urging the formation of trading groups, and at the same time so hampering their actions that they can hardly function.

One of these days we are going to be badly in need of coal, of business information, of foreign trade; and there will be an awakening as to the reasons for their absence. Then perhaps we shall take time to find out what is wrong with some of our laws and fix them up. Let us hope that it will not be too late.

Standards and Tolerances

ONE of the essentials in all standardization work is the adoption and use of standard tolerances as well as dimensions. The lack of this was the chief defect in the adoption of the Sellers or Franklin Institute or U. S. S. thread. But the oversight was perfectly natural and excusable as the use of definite tolerances had not been recognized at that time.

A very common difficulty along this line is to be seen in wrench fits on bolt heads at the present time. We have standard bolt heads and wrenches made in conformity with this standard. But it too frequently happens that the tolerance on the wrench is minus and on the bolt head or nut is plus, and the result is far from satisfactory.

There is, fortunately, a committee at work on the standardization of bolts, nuts and wrenches, which is, of course, working with the question of tolerances in view. The multiplicity of sizes now found on toolposts and other parts requiring adjustment, together with the lack of standard tolerances, makes the number of necessary wrenches altogether too great. This frequently results in a resort to the time honored screw or monkey wrench with the usual damage to the nuts or bolt heads.

The standardization of bolt heads should appeal to every builder of machine tools as well as to users. Such standardization will eliminate some sizes now used, will reduce the number of wrenches to be furnished with each machine and will make it easier to keep the machine in proper adjustment.

Standardization is in the air. Let us all work for rational standards for such parts as do not hamper future development of design.

Shop Equipment News

Hartness Comparator for Gaging Gears

The Jones & Lamson Machine Co., Springfield, Vt., has recently developed an attachment for use on its Hartness comparator when gaging gears. In order to permit the operator of the projecting lantern to have the projected and magnified image shown on a screen within his reach, a mirror is employed at some distance from the lantern so as to throw the image on the back of a ground-glass screen. The arrangement is shown in Fig. 1. The mirror is made especially for the purpose and has a deposit of silver on its front surface, in order to provide the highest degree of reflection. The arrangement is stated to give great accuracy, so that at a magnification of 100 diameters differences of 0.0001 in. can be detected.

With the set-up shown, parts having sharp outlines without burrs can be thrown clearly on the ground-glass screen. However, it is the usual practice to round or chamfer the ends of gear teeth, so that it is not possible to focus clearly on the edges of the tooth and thus obtain a sharp outline on the screen. To overcome this trouble, the instrument is focused at some point along the face of the tooth rather than on the very end of it. The gear is tilted very slightly, so that the light rays strike the side of the tooth.

Since the microscope has a very thin focal plane, it can be focused to show clearly points in one plane

FIG. 1. HARTNESS COMPARATOR FOR GAGING GEARS

and to leave other outlines blurred. If a needle is placed in the plane to be explored, it gives a very sharp projected point and shows the outline of the tooth. This outline lies in the image on the screen between the point of the needle itself and the reflection of it in the face of the tooth. In order to obtain this reflection, it is not necessary to polish the tooth face more than ordinarily done.

The method of mounting the gear and the needles in order to give the contour of the tooth is shown in Fig. 2. The effect produced on the image projected on the screen has already been noted in the previous figure. With this set-up, the comparator can be em-

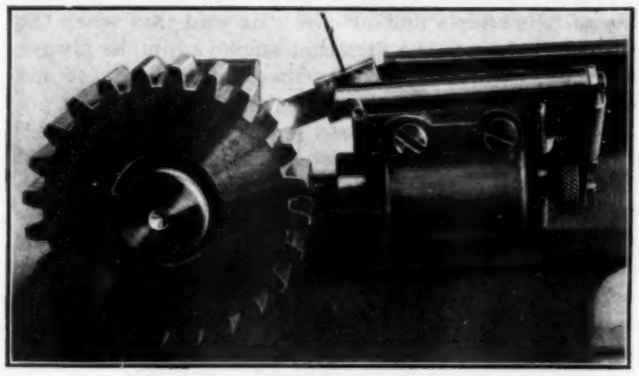


FIG. 2. ARRANGEMENT OF WORK AND NEEDLES ON COMPARATOR

ployed to show tooth shape very accurately. It should be noted that it is possible for several men to work simultaneously around the ground-glass screen without interfering with the image on it.

McCollum Electric Hoist

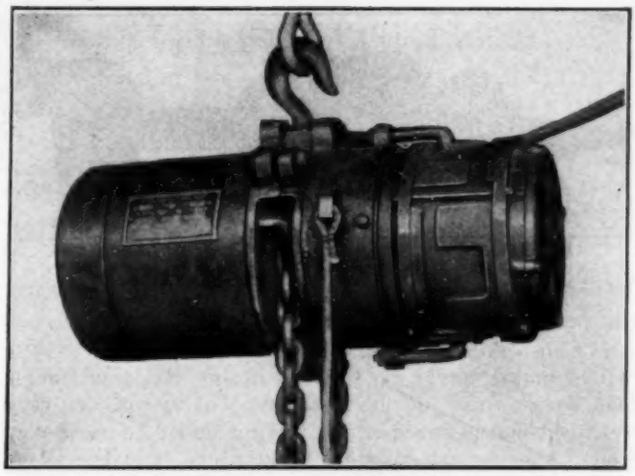
The Joslyn Manufacturing and Supply Co., 3,700 South Morgan St., Chicago, Ill., has placed on the market the McCollum electric hoist shown in the accompanying illustration. The speed-reducing gearing consists of three internal ring gears, three planetary pinions, and a high-speed pinion that is mounted on the motor shaft. The three internal gears are of the same diameter. The outer ones are housed in the frame so that they do not rotate; the middle gear has one more tooth than the outer gears, and is keyed to the chain sheave.

The planetary pinions have long faces, so that they mesh with all three internal gears. The driving pinion is in the center. A reduction of speed of from 100:1 to 350:1 is obtainable between the driving pinion and the sheave which carries the load. A great amount of bulk and weight is eliminated by the ability to use a high-speed motor, due to the large speed reduction.

The use of brakes is eliminated, since the action of the mechanism is not reversible. The speed-reducing gearing can be operated from the motor end only, and no load can be applied at the sheave that will cause the gears to rotate and thus lower the load.

The chain sheave is carried on roller bearings. The only strain on the motor shaft is that of the driving torque. A ball-bearing motor is used, and it can be tipped or turned in any position without spilling the oil. Either alternating- or direct-current motors using from 110 to 440 volts can be employed.

All gears are of machine cut, heat-treated steel, with



McCOLLUM CHAIN-LIFT ELECTRIC HOIST

the exception of those used in the smallest hoist, which are of cast iron. The hoist is supplied with either rope or chain lift, although the latter is recommended because of safety and durability. With the chain hoists, a hook can be used on either end of the chain; and for certain classes of elevating work, one load can be unloaded at the top while another is being loaded at the bottom. Only a small amount of head room is necessary for the hoist.

Cowan Steel-Frame Lift-Truck Skid

A steel-frame platform or skid for use with hand-operated lift trucks has recently been placed on the market by the Cowan Truck Co., 7 Water St., Holyoke, Mass. The frame of the skid consists of two 2½ x 2 x ¼-in. angle irons. Pine planking is secured to the angles by four countersunk bolts, two at each end of each plank.

The shoes or feet on which the skid rests are of malleable iron 1½ in. wide and ¼ in. thick, their shape being shown in the accompanying illustration. They are secured to both the top and the sides of the angle-iron frames, so as to prevent shaking of the platform. The feet are sufficiently rigid to prevent bending under the load, so that the platform retains the proper height. It should be noted that the feet are fastened at the very ends of the platform, so as to give it stability, and also to provide the greatest road clearance when the truck is approaching or leaving a grade. The durability and rigidity of the skid is particularly emphasized.

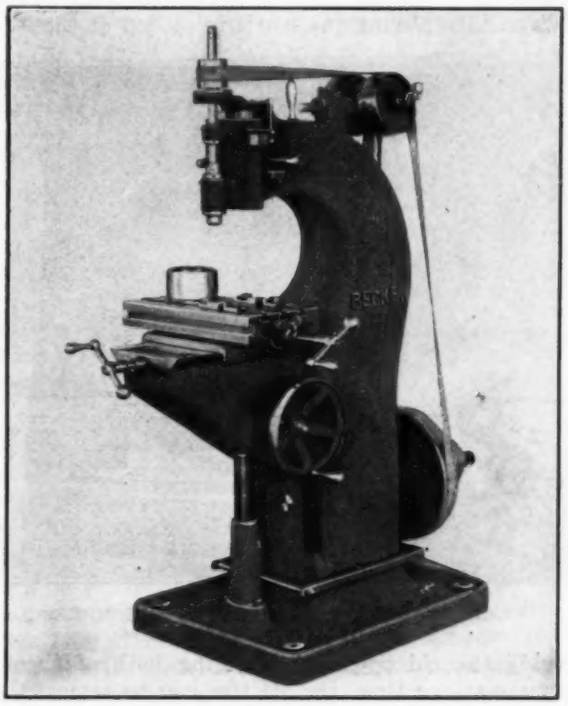
The skids are made in eight lengths from 24 to 80 in., and in nine widths from 24 to 48 in. All sizes can be furnished in heights of 6½, 7½ and 9½ in., and the larger sizes in 11½ in. height. Special sizes and forms of skid can be furnished to suit special requirements.

COWAN STEEL-FRAME LIFT TRUCK SKID

Becker No. 2 High-Speed Vertical Milling Machine

The Becker Milling Machine Co., 677 Cambridge St., Worcester, Mass., has recently made some changes in its No. 2 vertical milling and routing machine, in order to fit the machine for high-speed work. The principal change consists in equipping the machine with an auxiliary ball bearing to take the belt pull, so that the machine can be run at speeds at least 50 per cent in excess of those employed on the standard machine. The main bearing of the spindle is bronze with a babbitt lining. The thrust washers on the spindle are hardened steel.

The spindle itself is made of machine steel, and the collars and nuts that it carries are balanced. Two sizes of pulleys are provided for the spindle, a 3-in. pulley being supplied for obtaining high speed, in addition to the 5-in. pulley ordinarily used. To change pulleys, it is only necessary to lift one pulley from the sleeve on which it rests, and substitute the other pulley. The belt slack is taken up by means of the adjustable



BECKER NO. 2 HIGH-SPEED MILLING MACHINE

idler-pulley bracket. The high speed is found particularly useful for manufacturing stamps and stencils.

It is stated that the machine has been successfully run at speeds above 6,000 r.p.m., largely because the proper oiling facilities are provided to care for the high speed. When the maximum speed is 6,000 r.p.m. the other speeds obtainable with the 3-in. pulley are 3,240 and 1,800 r.p.m., and with the 5-in. pulley, 3,540, 1,920 and 1,060 r.p.m. The countershaft speed for such operation is 540 r.p.m. A canvas belt is employed for the high speeds. When lower speeds and larger cutters are employed, a leather belt may be used.

Another improvement in the machine is the use of a full box-form knee, which gives great rigidity. A steel chip guard is provided in the knee in front of the carriage, in order to protect the crossfeed screw.

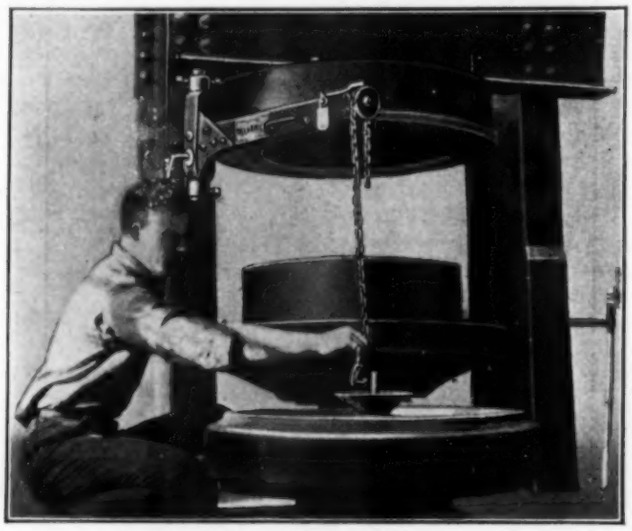
Reliance Wheel Hoist for Tire Press

A hoist intended for use on a press to lift automobile truck wheels into place when changing tires has recently been brought out by the Reliance Trailer and Truck Co., Inc., 1642 Howard St., San Francisco, Cal. The device is known as the pressman's helper, as it enables one man to operate the press. The illustration shows the operator attaching the hook to the wheel.

Two clamps are secured to the upright frame of the press. The clamps carry brackets in which the trunnions of the swinging arm are fastened. Since the brackets are adjustable on the clamps, it is possible to position the device so that the center line of the chain will cross the center line of the press platen.

Hoisting is accomplished by hand, through a gear reduction connected to the crank at the pivoted end of the device. Turning the crank operates the small chain pulley at the outer end of the arm, so that the chain and load are lifted. When not in use, the arm can be swung back clear of the opening in the press.

The wheels are secured by means of cones placed in the hubs. When the upper cone is placed on the shaft of the lower cone, the wheel is prevented from slipping sideways. By placing the new tire on top of the wheel



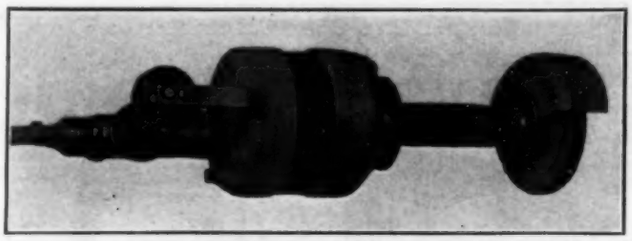
RELIANCE HOIST FOR TRUCK TIRE PRESS

carrying the old one, and swinging both of them in the press at one time, the old tire can be removed and the new one applied in one operation. Centering and positioning the tire before lifting the wheel into the press is easily done.

The device saves time and labor on the part of the operator and greatly lessens the chance of injury in handling the wheels. Besides being used on a tire press, the hoist is adaptable to general work around the shop. Different brackets can be furnished for securing it. Its lifting capacity is 1,200 pounds.

Forbes & Myers Model 35 Portable Electric Grinder

The portable electric grinder illustrated herewith has recently been brought out by Forbes & Myers, 172 Union St., Worcester, Mass., and is designated as the Model 35. The device is of the squirrel-cage induction type and has fire-proof windings. The insulation is asbestos that has been given a special treatment to bind



FORBES & MYERS MODEL 35 PORTABLE GRINDER

the fibers into a tough, flexible mass capable of withstanding a red heat indefinitely.

The motor has ¾ hp. It maintains its speed under load better than the universal type of motor. It very quickly regains speed after slowing down due to heavy load. The normal speed is 3,600 r.p.m., and the wheel ordinarily carried is 6 x 1 in. in size. The bearings are self-lubricating and of the metal-graphite type.

In order to prevent the possibility of the operator receiving an electric shock from the tool while handling it when standing on a damp floor or when making contact with metal, a grounded wire is employed. This wire adds but little weight to the cable, and can be attached to a water pipe or some permanent ground while the tool is in use. The wheel is equipped with a guard, and convenient grips are provided for the operator. The switch is within easy reach in the handle.

Gammons-Holman "Parob" Expansion Reamer

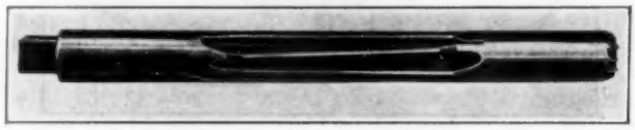
The Gammons-Holman Co., Manchester, Conn., is introducing a form of expansion hand reamer, known as the "Parob" because of the fact that the cutting edges are alternately parallel and oblique.

The reamer is of the type that is expanded from the center by means of a tapered plug, adjusted by a screw in the end. The end of the pilot is recessed to a considerable depth for the double purpose of protecting the head of the screw, and to allow the reamer to be placed upon centers for regrinding. A hole of generous size in the squared end admits oil to the central cavity, from which it may flow through the slots to the cutting edges.

The advantage claimed for the peculiar disposition of the cutting edges is that as each parallel blade is followed by one obliquely disposed, chatter is eliminated. It is also claimed that the blades are more easily honed, without danger of rounding over the cutting edge, than is the case with helical fluted reamers.

A feature of the reamer is the placing of cutting edges upon the extreme end of the pilot portion for the purpose of removing burrs and permitting the reamer to enter the hole easily. This feature is called the "burr cutter."

The reamers are made in one piece, with blades cut from solid stock, and receive a special heat-treatment designed to insure long life and retention of keen cutting edges. They are made in standard sizes from ½ in. to 1½ inches.



"PAROB" ONE-PIECE EXPANSION REAMER

Ramsdell Hand Vise-Lathe

The Campbell Manufacturing Co., Slater Bldg., Worcester, Mass., has recently placed on the market a device known as the Ramsdell hand vise-lathe. The tool is intended to enable accurate cutting from bar stock without the use of a lathe or screw machine such work as screws, studs and pins. With it wire springs can be wound to any desired pitch. The tool is made

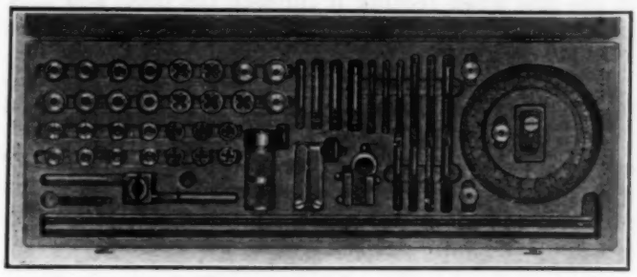


FIG. 1. RAMSDELL HAND VISE-LATHE SET

especially for garage men, automobile owners, farmers and those who have occasion to repair machinery without having machine tools available.

In Fig. 1 the tool is shown packed in a box with the necessary taps, dies, bushings, cutting tool and spacers, all readily accessible. Any combination of bushings, dies and taps in U. S. S. or S. A. E. standard threads can be furnished. By means of the dies and wrench, bars can be threaded in the ordinary manner. For turning, however, the set-up shown in Fig. 2 is employed. It is necessary to have in addition to the tool only a vise in which to hold the stock.

Bar stock up to and including 1 in. in diameter can be handled, thus enabling the operator to make hexagon-head capscrews up to $\frac{3}{8}$ in. in size, square, fillister and round-head capscrews up to $\frac{1}{4}$ in., flathead capscrews up to $\frac{5}{16}$ in. and button-head screws up to $\frac{3}{8}$ in. Each set is furnished with centering bushings from $\frac{1}{4}$ to 1 in., by $\frac{1}{16}$-in. steps. Any required length of screw, stud or spring can be made.

The combined die and toolholder is shown with a cutting tool in position and removing a chip from the work. Hand feed is provided, so that the operator may take either a light or heavy chip. The required size of die can be fitted in the upper portion of the holder, and a centering bushing secured in the lower portion. Since the stock must first pass through the centering bushing, the thread cannot be cut off center. The arrangement also prevents screws and studs from being turned eccentrically. A knurling attachment is provided in the equipment. All wearing parts of the device are casehardened.

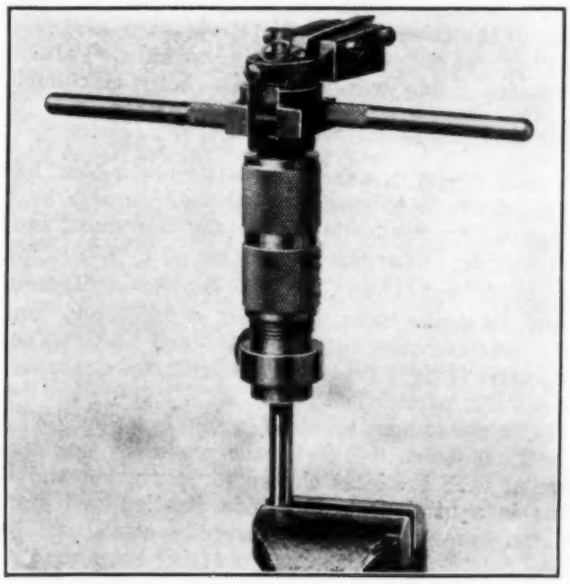
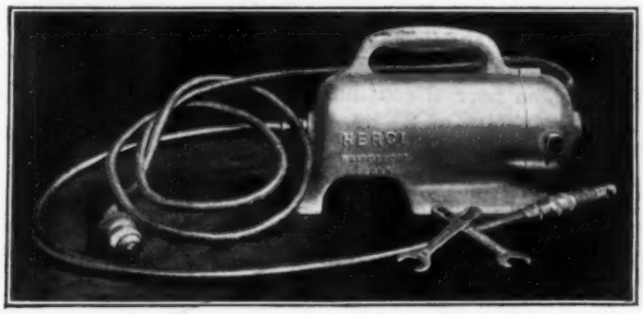


FIG. 2. TURNING WITH HAND LATHE

Hergi H-250 Flexible-Shaft Outfit

The illustration shows a motor-driven flexible-shaft outfit recently placed on the market by the Hergi Manufacturing Co., 250 Fifth St., Bridgeport, Conn. A high-speed motor, of $\frac{1}{8}$ hp. and capable of operation on 110-volt alternating or direct current, is inclosed in an aluminum casing having a base and handle integral with it. It is thus possible to easily pick up the entire unit and carry it to the work.

A ventilating fan is provided to keep a current of air passing between the field and the armature windings. Since the air current also passes between the spokes of the front bearing and through a series of holes around the bearing in the end cap, both bearings are cooled.



HERGI H-250 FLEXIBLE-SHAFT OUTFIT

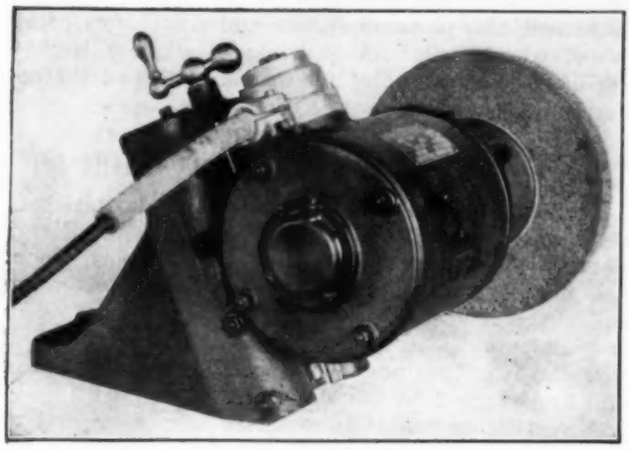
The shaft is $\frac{1}{4}$ in. in diameter, 3 ft. long and wound with wire. The sheath is metal inside and is covered with whipcord. A ball-bearing handpiece with a $\frac{1}{16}$-in. chuck is provided. The No. 4 or 5 shaft, sheath and handpiece are interchangeable on the motor unit.

Six feet of drop cord with an attachment plug are provided with each motor. Since the cord is fastened inside the end plate, no external binding post is necessary. The unit is simple and has but few parts; and it is known as the Type H-250 or 1922 model. It is adaptable to the all work ordinarily handled by flexible-shaft equipment.

Van Dorn Angle-Plate Grinding Attachment

The Van Dorn Electric Tool Co., Cleveland, Ohio, has just placed on the market the 12-in., motor-driven, angle-plate grinding attachment that is shown in the accompanying illustration. The principal feature is the inclined slide, which permits of movement in one plane for both feed and adjustment of the height of the spindle. The effect of both horizontal and vertical slides is thus obtained, with the simplicity and rigidity of a single slide. The rigidity of the machine is greater than that of the type with a vertical slide, as the machine can stand firmly on its base without fastenings.

The shaft is 1⅞ in. in diameter through the motor and 1 in. through the wheel. The heavy-duty ball bearings are mounted in dust-proof housings and are grease lubricated. Motors for alternating or direct



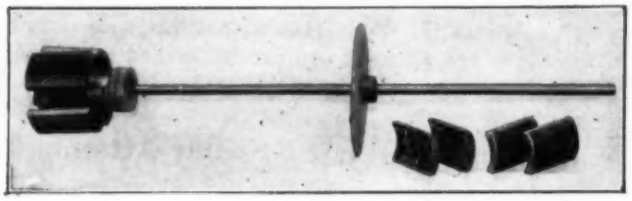
VAN DORN ANGLE-PLATE GRINDING ATTACHMENT

current are interchangeable in the same housing. These motors are designed and built by the concern for grinding service; they are tested and rated to meet the standards of the A. I. E. E. and the Electrical Power Club. The normal continuous capacity is 1½ hp., with a peak capacity of 2¼ hp. The speed is 1,800 r.p.m.

It is stated that under test a roll 7 in. in diameter was ground in a large lathe at a speed of 60 ft. per minute and a longitudinal feed of the carriage of ⅛ in. per revolution, a cut 0.002 in. deep being taken continuously. The net weight of the attachment is 175 pounds.

Stimson Internal Lapping Tool

In the accompanying illustration is shown a device for lapping the bores of automotive cylinders. The tool has recently been placed on the market by the Stimson Engineering Co., 598 Sixty-Eighth Ave., Milwaukee, Wis. It will be noted that shoes which make contact with the cylinder bore are held by flexible connections at one end of a shaft. The shoes can be easily removed; two sets are provided, one to fit bores 2¾ to 3½ in. in diameter, and the other for bores from 3½ to 4¼ in. In order to fit the shoes to the size of the



STIMSON INTERNAL LAPPING TOOL

cylinder, a nut operating the taper adjustment is provided. A locknut clamps the adjusting nut, so that the tool can be held at any particular size.

The disk mounted on the shaft is adjustable in position, so that it acts as a stop and prevents the tool from feeding too deeply into the cylinder. The tool is ordinarily operated by an electric- or air-driven portable drill, or by a drilling machine, although it can be attached to the tailstock of a lathe.

It is not necessary to remove the cylinder block from the chassis of the automobile, in order to finish the bore. The tool requires no lining up with the cylinder, as the shoes can swing to adjust themselves to the work. It cuts the carbon and roughness from the surface of the cylinder, a grinding compound being employed to facilitate this action. The bore can be finished both round and straight. Points where the diameter is smaller can be felt by the resistance offered to the tool when feeding it through the bore, and they can be given special attention. The tool is expanded as the work progresses.

The tool may be employed without the shoes for holding pistons when filing them to size. The shaft is held in bearings and rotated by means of a portable drill, or it can be secured in a lathe chuck and supported by a steady rest. Thus a new piston can be finished to the size necessary to fit the reground cylinder.

How Shall We Designate Tolerances?

BY FRANK C. HUDSON

The problem of designating tolerances has several angles. There is no question as to the advisability of unilateral tolerences, so far as basic dimensions are concerned, but a very practical engineer of my acquaintance brings up some interesting points as to the best way of showing tolerances.

He believes in the one-way or unilateral tolerance but not in the unilateral designation of it. Suppose the basic dimension for a hole in a bushing is 1.790 in., with a permissible maximum of 1.792. The usual method of dimensioning the drawing would be $1.790^{-0.000}_{+0.002}$ or 1.790 in. + 0.002. The shaft dimension would perhaps allow for a minimum of 0.002 clearance and would read $1.788^{+0.000}_{-0.002}$ or 1.788 — 0.002, giving a maximum of 0.004 in. clearance.

His experience shows that as men endeavor to work to the dimension they see plainly, at the same time playing safe on the tolerance side, there will be a tendency to get maximum clearance instead of a medium between the two. His preference is for dimensions as follows: 1.791 ± 0.001 and 1.787 ± 0.001. He believes that while this gives a maximum possible clearance of 0.005 in. you will get much nearer an average of 0.003 in. than in the other case.

Other ways of designating tolerances also have advocates. One way is to give both maximum and minimum dimensions such as $\frac{1.792}{1.790}$ or $\frac{1.788}{1.786}$.

Another way which is unusual, but which has its good points, is to give the basic dimensions as 1.790 and use two minus tolerances for the shaft and two plus tolerances for the hole. This gives $1.790^{-0.001}_{-0.003}$ for the shaft and $1.790^{+0.001}_{+0.003}$ for the hole. This shows clearly that the basic dimension is 1.790 and that the shaft size can vary between 7.789 and 1.787. The hole can vary from 1.791 to 1.793 with no clearance less than 0.002 permissible.

Pet systems have no place in this question. We want a method which will show the workman just what is wanted with the least chance for confusion and error. This is a vital part of standardization and standard tolerances and should be carefully considered by all those interested in shop and drafting room practice, in order to promote accuracy, speed and uniformity.

News Section

Government Revives Patent Convention with Germany

After an extended study of all the ramifications of the proposal that the Patent Convention of 1909 with Germany be allowed to lapse, the State Department decided to revive the convention, and notice to that effect was transmitted to the German authorities prior to May 11, which was the time limit for such notification. The revival of this convention gives the holders of American patents, registered in Germany, immunity from the working clause in the German patent law. Strong pressure was brought by the War Department and the chemical industry against the revival of the convention. The War Department is anxious to secure the enactment of a working clause to apply to all patents registered in the United States. The American chemical industry has comparatively few patents registered abroad. On the other hand Germany has a large number of patents registered in this country which are not being worked. The effect is to preclude the development in this country of numerous branches of chemical manufacturing.

Manufacturers of machinery in the United States were among those who were most strongly in favor of reinstating the convention with Germany. It was stated that it would cost machinery manufacturers millions of dollars to undertake the manufacture of their patents in Germany. The electrical industry also would have been affected adversely had the convention not been continued.

Nominations for A. S. M. E. Officers Announced

The nominating committee of the American Society of Mechanical Engineers, headed by W. W. Varney, of Baltimore, has made its report to the society on the choice of candidates for officers in the association.

The committee offers the following names: For president, John Lyle Harrington, of Harrington, Howard & Ash, Kansas City, Mo.; for vice-presidents: W. S. Finlay, Jr., American Water Works and Electric Co., New York, W. H. Kenerson, Brown University, Providence, R. I., Earl F. Scott, Earl F. Scott & Co., Atlanta, Ga., and H. H. Vaughan, Montreal, Quebec, Canada (to fill unexpired term of L. E. Strothman). For managers: A. G. Christie, Johns Hopkins University, Baltimore, Md.; James H. Herron, James H. Herron Co., Cleveland, Ohio; Roy V. Wright, Simmons-Boardman Publishing Co., New York. For treasurer: William H. Wiley, John Wiley & Sons, New York.

For delegates to American Engineering Council: John Lyle Harrington, L. P. Alford, A. M. Greene, Jr., Fred J. Miller, Max Toltz, Fred R. Low, S. W. Stratton, Edward R. Fish and Edwin B. Katte.

Industries of Southeast Show Improvement Over 1921

A steadily increasing demand for iron and steel products during the past two months, with every indication that business will continue to grow more healthy during the remainder of the year, has served to materially brighten the iron and steel outlook in the Southeastern territory, and especially in the Alabama and Birmingham district.

During the past five or six weeks this demand has brought about the resumption of operations at a number of furnaces in the Birmingham district that have been closed for several months, some of them for more than a year. Others in the district are preparing to start operations again as soon as business reaches a point that will merit steady activity.

One of the largest industries in the district that is now operating at 100 per cent capacity is the Tennessee Coal, Iron & Railroad Co., in steel production, while the structural mill is on a double turn. The other mills of this company, while not running at 100 per cent of capacity, are in active operation.

Outside of Alabama, iron and steel conditions over the Southeast are noting the general improvement, but not to as great an extent as in the Alabama district. Activities are at a lower ebb in Georgia, North Carolina and Tennessee than in Alabama, but the outlook promises much greater activity before the end of summer.

General business conditions are steadily improving and industrially at least the section is rapidly assuming an era of normal activity.

Because of the depression of last year the manufacturing companies of Georgia were not nearly as prosperous in 1921 as they were in 1920. It is stated that Georgia has a total of 5,123 manufacturing industries. The total capital invested in the industries of Georgia during 1921 was $441,505,757, which was less by $7,000,000 than the previous year.

Machinery Exports Exceed Pre-War Figures Says Dr. Klein

In an address before the U. S. Chamber of Commerce convention in Washington last week Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce of the Department of Commerce, said that exports from the United States of industrial machinery are now 60 per cent above pre-war level, with expanding markets in India, Japan, Dutch East Indies, Brazil, Argentina, and a tendency toward basic improvement in Cuba and Mexico. Reports from some smaller countries also show that conditions of trade are improving and that prospects for further trade are better.

Freight Loadings in April Increase in Volume

Reports just received by the car service division of the American Railway Association show that 758,286 cars were loaded with revenue freight during the week ending April 29, compared with 714,088 during the previous week, or an increase of 44,198. This was the largest number of cars loaded during any one week in April and was an increase of 37,202 over the corresponding week in 1921.

Increases compared with the preceding week were reported in the loading of all commodities. Merchandise and miscellaneous freight, which includes manufactured products, totaled 534,651 cars, an increase of 18,631 over the preceding week and 81,889 in excess of the total for the corresponding week last year.

Coal loadings totaled 75,632 cars, 12,187 more than were loaded during the previous week and the largest number loaded during any one week since the coal strike began. This was, however. 68,228 below the corresponding week last year and 93,086 under the total for the same week in 1920. Coke showed an increase over the week before of 343 cars which brought the total to 7,952 cars. This was 3,175 more than were loaded during the same week last year. Tabulations showed 14,053 cars loaded with ore, an increase within a week of 4,283 cars and an increase of 6,277 over the corresponding week in 1921. During the corresponding week in 1920, however, 28,814 cars were loaded with ore, which is nearly twice as many as this year.

Swope Elected President of General Electric

Following a meeting of the board of directors in the General Electric Co., held in New York on May 16, Gerard Swope, president of the International General Electric Co., was elected president to fill the position vacated by the resignation of E. W. Rice, Jr., who in turn becomes honorary chairman of the board of directors. At the same meeting, C. A. Coffin retired as chairman of the board and was succeeded to that position by Owen D. Young, long associated with the company as vice-president. Anson W. Burchard, for many years the vice-president in charge of public utilities and foreign investment was elected vice-chairman of the board. Additional directors added to the board are J. R. Lovejoy and G. F. Morrison.

Mr. Swope, the new president, is a graduate of the Massachusetts Institute of Technology and received his early technical practice in the shops of the Western Electric Co., at Chicago. He was elected president of the International organization in 1919.

Mr. Coffin will continue as a director and as consulting engineer.

The Trend of Business Improvement—Plants Resuming

The Standard Foundry Co., Anniston, Ala., has resumed production at the local plant of the Lynchburg Foundry Co., and expects to develop capacity operations at once. The other plants of the company are also running at regular output.

The Willys-Overland Co., Toledo, Ohio, is increasing production to a basis of 400 cars a day of Overland and Willys-Knight models. Employment is being given to about 8,000 men, and it is proposed to advance this quota at an early date. A call has been issued for skilled mechanics.

The Maxwell Motor Car Co., Detroit, Mich., is running on a full production basis at its plant, averaging 300 automobiles a day. The company has recently added another 100 men to the force, totaling over 1,000 additional during the last three weeks. Production is being increased at the Dayton, Ohio, plant, and it is planned to place this works on a capacity schedule at an early date, giving employment to about 1,000 men.

The American Locomotive Co., is scheduling a portion of recent orders for production at the Brooks plant, Dunkirk, N. Y., including 50 engines for the Chicago & Northwestern Railroad Co. The working force will be increased at once.

The Anchor Concrete Machinery Co., Adrian, Mich., manufacturer of concrete block and tile-making machinery, has developed maximum output at its new local plant, comprising the former works of the Adrian Steel Castings Co., and has plans under way for immediate expansion, including the erection of a new addition. The plant now operated at Rock Rapids, Iowa, formerly the main factory, will be removed to Adrian.

The New York Central Railroad Co. is arranging for the immediate resumption of operations at its Hobson repair shops, near Middleport, Ohio. Former employees will be engaged on a piecework basis.

The Bessemer & Lake Erie Railroad Co. is planning to resume operations at its Greenville, Pa., shops by the close of May. The works were recently closed down. Employment will be given to about 1,500 men.

The White Motor Co., Cleveland, Ohio, has added about 750 men to the working force during the past few weeks, increasing the quota to 3,000 employees. Motor truck production has been developed to a point of over 800 cars a month.

The Newport News Shipbuilding and Dry Dock Co., Newport News, Va., is arranging for immediate increase in operations, with employment of additional men. The company has received an order from the Chesapeake & Ohio Railroad Co., for 3,000 gondola cars and 1,000 steel cars for general service.

The Farrell Works plant of the Carnegie Steel Co., at Farrell, Pa., has started eight open-hearth furnaces.

The Steel Products Company, Cleveland, Ohio, is adding steadily to its operating staff. About 400 men are being employed. The force at the Detroit plant, local officials assert, is also being increased. February business increased in volume 50 per cent over January. The company is making principally bolts and valves for the automotive trade.

Inquiries for low-priced motor car bodies have increased to a considerable degree in the last few weeks, according to announcement made this week by officials of the Fisher Body Co., Cleveland, Ohio. The plant is operating nearly to capacity, turning out 200 bodies a day. The company plans to put on more men, in order to take care of the business that has come in lately.

Six more hot mills of the American Sheet and Tin Plate Co., at Pittsburgh, Pa., were reopened on March 20.

The Morgan Engineering Co., Alliance, Ohio, has received an order from the Wheeling Steel Corporation, of Wheeling, W. Va., for twenty-two cranes up to 125 tons capacity; also for three shears up to 900 tons capacity. Additional men will be employed at the Morgan plant to take care of this and other orders.

The Nash Engineering Works at South Norwalk, Conn., is reported working on full-time with a normal production force.

Automotive Engineers Meet at White Sulphur Springs

Plans are fast being formulated for the summer meeting at White Sulphur Springs, Va., June 20 to 24, of the Society of Automotive Engineers. Reservations have already totaled over five hundred. Special railroad rates have been secured for members and guests and the certificates will be ready for applicants on June 10. Special trains have been arranged to transport the Eastern and Western contingents to White Sulphur. The Mid-West section will have a special train out of Chicago; the Detroit and Cleveland sections will also have special trains.

The technical program for the meeting is practically completed. The meeting has been divided into five sessions as follows: Research Session; Fuel and Engine Session; Passenger Car Session; Aeronautic Session; and Motor Bus Session. A report from the research department of the society will be presented by Dr. H. C. Dickinson. This report will treat principally of the volatility of motor fuel. Fuel tests will be described by W. S. James of the Bureau of Standards. Several papers will be presented at the Fuel and Engine Session; among them will be a compilation of data on the characteristics of blended fuels by Thomas Midgley, Jr. Speakers at the Passenger Car Session will be H. M. Crane, P. M. Heldt and J. B. Bray. The Aeronautic Session will include papers on several phases of aircraft progress. Two of the papers will be by Capt. G. E. Hallett, of the Air Service, McCook Field, and Prof. E. P. Warner. In the Motor Bus Session papers will be presented by G. A. Green and R. E. Plimpton. The entertainment committee has planned several events of a social and sporting character to offer some diversion from the technical sessions.

Carnegie Tech Students Form Chapter of S. I. E.

A chapter of the Society of Industrial Engineers was recently organized among students at Carnegie Institute of Technology, Pittsburgh, to be known as the Carnegie Industrial Engineers Society.

The department of machine construction, under Prof. Charles C. Leeds, organized the chapter, which includes 108 members. Prof. Joseph W. Roe, president of the Society of Industrial Engineers, was present at the initiation and spoke to the members. Dr. A. A. Hamerschlag, president of Carnegie Tech, also gave an address and was made honorary chairman.

The officers are: President, R. W. Marshall, of Pittsburgh; vice-president, J. V. Foster, of Latrobe, Pa.; secretary, J. K. Matter, of Harrisburg, Pa.; treasurer, B. N. Greenlaw, of Ridgewood, N. J.

Engineers To Continue Campaign for Public Works Department

Warning that President Harding is encountering opposition so strong that his efforts at government reorganization may be defeated, the American Engineering Council of the Federated American Engineering Societies has announced that the engineers of the nation will start afresh a nation-wide movement for the establishment of a National Department of Public Works.

In a statement saying that the public works question would come up at a meeting of the executive board of the council in Pittsburgh, May 26 and 27, it was asserted that government reorganization is being blocked by "the petty jealousies and conceits of men in high official position."

L. W. Wallace, of Washington, executive secretary of the Federated American Engineering Societies, through whom the statement was issued, said that Dean Mortimer E. Cooley of the University of Michigan and president of the council, recently visited President Harding, to whom he tendered the support of the organized engineers of the nation in matters affecting engineering and allied service.

One part of the statement reads as follows:

"Men in high official positions, accustomed to the handling of large affairs prior to the beginning of their official life, and whom one would naturally suppose must be above the petty jealousies and conceits of the average man are now exhibiting jealousies and animosities that one might expect to come from a group of children quarreling over the distribution of sweetmeats. Various organizations of high repute, led by men of high character, are supporting these absurdities with an intensity almost unbelievable.

"The country needs right now the voices of those who look and think beyond the outer skin. We always have with us the voice of the crowd, too often impelled by unwise leadership and mob psychology. Every little while it is incumbent upon the thinking portion of our citizenship to render public service."

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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While the speculators in securities are merrily buying stocks and bonds that can be instantly resold if the tide should turn, the merchants and manufacturers of the country are still considering the policy that they ought to follow in preparing for the autumn trade that should normally follow the harvest season.

This problem is a difficult one, for the articles that compose a retailer's or a jobber's stock cannot be resold like stock exchange securities and an error in calculating the prospective demand often means a ruinous inventory loss. Similarly a manufacturer runs great risks when he puts his capital into the production of goods that are not sold before they are made, but these are risks that many are taking today.

Buyers Are Cautious

It is undeniable that the advance in most basic raw materials far exceeds that which is obtainable for their manufactured equivalent from consumers, and the intermediary distributor, remembering the experience of two years ago, is wondering whether another "buyers strike" might not follow an effort to equalize retail prices with production costs.

It is generally believed that stocks are small and shelves bare. This belief is confirmed by the relatively small amount of first-class commercial paper offering and the question that nearly every merchant is now asking himself is "shall I buy or wait?" Cotton, for instance, is well over 20 cents a pound, but the trade in cotton goods, though better than it was, does not fully reflect the advance in the raw material. The same thing is true of wool and woolen goods, hides, leather and shoes, silk and silk fabrics, hogs and hog products, wood pulp and paper.

The disparity between retail prices and the cost of production is of course appreciably increased by high freights, high wages and heavy taxes, and although it is hoped that at the dinner he gave them President Harding may have persuaded the railway executives to slightly reduce the cost of transportation, there are few who expect any reduction in wages or taxes. This being the case it is plain that unless the price of agricultural products can be lowered there is not much chance of a further decrease in the cost of living.

Those who believe that the farmer can be forced to accept substantially less than he is now getting for the fruits of his toil disregard his newly acquired political power and self-consciousness. I cannot expect any substantial decline in farm products and am therefore impelled to conclude that the trend of retail prices will be upward during the balance of this calendar year and until the crops that mature in 1923 are far enough advanced to have an influence upon the markets.

This is a rather long distance view to take of a profoundly important question, but after studying it from every angle I cannot reach any other conclusion. We have in the first place an abundance of credit. The ease of money is rapidly thawing out and liquifying the frozen loans of which we had heard so much. The enormous bond sales of the past six months have made it possible for many corporations to buy the new equipment of which they are in need. Its fabrication will provide employment for those formerly unemployed. A scarcity of labor is in fact already reported from some points in the Middle West. An increase in the consumptive demand will be the result and when this occurs an advance of four or five cents a yard in the cost of cotton cloth or four or five dollars in the cost of a suit of clothes will not deter those who have the money with which to satisfy a long felt want.

There may be some reason to doubt whether further advances in some agricultural products can be maintained, but with cotton at twenty cents, wheat at $1.25 and corn at over 50 cents on the farms the position of the farmer is greatly improved and he will be able to buy much that he was compelled to deny himself a year ago.

The idleness and loss caused by the textile strike in New England and the coal strike are not disregarded in this prognosis, but the cotton operatives are gradually returning to work and there is good reason to hope that after President Harding has finished with the steel men and the railroad officials he and Mr. Hoover will turn their attention to the coal industry and find a way to start it going again.

A Loan to Germany

The Genoa Conference has been a fizzle, it is true, and no one expects much of the gathering that is to be held in June at the Hague, but sterling exchange reached a new high record last week and America regards this as more important and significant than a trade agreement with Russia, which country, as Mr. Hoover points out, took only one per cent of our pre-war exports. It is, however, reported from Berlin that Mr. Morgan will head an international syndicate that will lend Germany 5,000,000,000 gold marks, equal to $1,250,000,000. If this should be true the effect in England and France would be electrical, but the resulting deflation in Germany might be depressing and would put an end to the abnormally cheap production which now enables German manufacturers to undersell the rest of the world.

All this would of course be to America's advantage and the effect would be to inflame speculation here, particularly on the Stock Exchange, where an appreciation of the possibilities was expressed by great activity last week.

The bond issues were, however, less numerous, and in accordance with precedent more attention is now being given to stocks. The consolidations, effected and rumored, in the steel industry have been used to advance the stocks of the corporations involved and others indirectly affected, but there is still a fear that the Department of Justice may thwart one or more of the proposed combines. This fear would seem to be unwarranted for the present Administration is not opposed to big business and the reports of President Harding's dinner to the steel men last Thursday evening indicate that its purpose was an abolition of the 12 hour day in the mills rather than an interference with the proposed combinations.

Large Industries Busy

In the steel industry itself there is a constant and noticeable increase of activity. Many mills are now working up to capacity and the average is put at 70 per cent of maximum. Prices for both iron and steel are higher and copper is up to 13¼ cents. The automobile industry is also booming and it is asserted that the May production of passenger cars will be the largest on record. This means an increased demand for tires later on. It ought to have its effect on rubber, which still hangs around 16 to 16½ cents for the standard grades.

The railroad earnings for April thus far reported are encouraging, but the buying of railway stocks was checked by the thought that the President may demand more of a reduction in rates than the roads can afford at present. If this apprehension proves to be unfounded higher prices for many railway securities will probably be recorded as the various combinations talked of take more definite shape. The weekly statement of the Federal Reserve System shows no important changes. The reserve ratio is 77.6 per cent as compared with 77.3 a week ago.

In America nearly all the indicia of business indicate greater activity. The chain stores report a large increase in sales and the mail order houses are now running ahead of last year. Bank clearings tell the same story.

The figures of our foreign trade for April show a decrease in both exports and imports, which is not surprising, but the excess of exports over imports was $104,000,000 as compared with $86,000,000 a year ago, which is better than was expected.

The trade reviews are generally cheerful and everywhere on this side of the Atlantic the barometer appears to be rising. It may, of course, go so high that a further rise would be impossible. Then it will be well to shorten sail, but for the present this seems unnecessary provided the commercial mariner does not relax his vigilance in scanning the horizon for signs of a change in the weather.

Germany's Labor Problem

Cheap Labor the Basic Factor in Present Economic Condition—Relation of Wages to Depreciation of Currency—Labor Legislation in the Factories

By OUR BERLIN CORRESPONDENT

Germany represents to-day, as far as business is concerned, an oasis within a vast desert. Situated in the midst of countries which are all more or less suffering under a prolonged and extensive business depression, Germany affords a contrast which perhaps was never more striking than now, when the intensity of production has reached its utmost limit. The reason for this remarkable condition is well known, and there is probably no one in the country who deludes himself into the belief that the excellence of Germany's products has procured for her the exceptional position she enjoys among other nations.

The truth is that Germany presents to her own inhabitants and to the rest of the world a huge warehouse where sales can, or are supposed to, be had at bargain prices. As almost everyone in the world is concerned in the question why such a state of affairs exists, and how long it can be maintained, Germany's economic conditions have become the subject of the closest scrutiny of all sides. When a foreigner comes to the country, one of the first questions he asks is, "How can Germans sell their products so much cheaper than other nations?" The reply he invariably receives can be condensed into the one word "valuta"; meaning the exchange, an all powerful word which is supposed to solve every puzzle that may present itself to the foreign mind, expressing all that there is to be said.

The discerning mind can, however, receive no satisfaction from such reply. The problem is much more complicated, and cannot be explained in a few catch words. It is not controlled by one economic function, but by a number of them. Their relations to each other and the sequence of actions and reactions they produce have never before been experienced in the history of mankind, which makes the situation hard to be understood by outsiders as well as by Germans themselves. The understanding is in no way facilitated by the fact that part of those economic functions are a product of natural development, and others are caused by deliberate manipulation. It can be said that even those most concerned, Germany's economic and political leaders, are not free from the confusion thus created. If they were, they would have succeeded in keeping the current of developments under control. The part that the administration plays is confined to producing some bends and twists in one place or straightening out some in other places, as seems advisable in the interests of the country.

Off Her Equilibrium

Germany represents to-day a territorial unit in which the economic atmosphere, if this figure of speech is permitted, is out of equilibrium with that of countries living under normal or nearly normal conditions. It may be compared to a vessel from which the greater part of its substance has been ejected, causing a partial vacuum. The suction thus created is the force which constitutes Germany's chief motive power. As this vessel is not a self-contained unit but subject to intercommunication with its surroundings, diffusion of course takes place through its walls, varying according to the difference between the inside and outside pressure, with the tendency to restore the equilibrium. In this simile, pressure is synonymous with prices. Granted f r e e inter-communication, prices in Germany would adjust themselves automatically to those of other countries. The exchange has in truth nothing to do with the level of prices. It can change only figures, but not the value they represent. The explanation of the problem, which the low prices in Germany represent, is to be found on the one hand in the fact that the effects of the diffusion have always been counterbalanced, and more than that, by further evacuation, and that on the other hand the process of the diffusion is by a most elaborate and intricate economical system been retarded considerably.

Government at Fault

During the war and almost two years after its end, this system consisted chiefly of enforcement of maximum prices on all commodities of every-day life. Since their abolishment the control has become much more difficult and also more intricate, hardly being recognizable from outside. Even such close and painstaking students of Germany's economic life as the foreign commissions of control residing in Germany are attributing the low level of prices in Germany to the government's maniplation of the price of grain, and to the low price of coal and transportation. The first is comparatively so insignificant that its influence on the general level of prices is almost nil. The cost of coal and transportation, on the other hand. is not an absolute quantity but a function of a factor which in truth is the basic factor in the whole problem—the cost of labor.

The question to be asked, and which indeed is asked incessantly without finding a suitable reply, is how in so nearly a socialized state as Germany is, the cost of labor can be kept down so far below the pre-war standard. At present a skilled workman receives on the average 140m. for a working day of eight hours, which is only 2m. gold, or a third part of his pre-war earnings.

That the increase of the wages above the pre-war standard is an entirely fictitious quantity is now realized by everybody concerned, even the most unsophisticated workman. It is true that the high figures which wages have reached are not devoid of exercising some fascination, creating some self-deception in the mind of the workingman. This fact, no doubt, has been responsible in some measure for the working classes' acquiescence in the disparity between their present and pre-war income.

The discontent thus produced has always been at the bottom of the labor problem, and its allaying was one of the chief tasks of the administration since it took the labor problem firmly in hand after the Revolution. The handling of the labor problem by the government and by the industrial associations has seldom found favorable comment, and has been grossly abused from both sides, the employers as well as the employees. When looking back to the revolution and reviewing the whole route transversed since then, there can be no doubt that the performance has so far been a very creditable one, deserving admiration rather than abuse.

The Labor Problem

The two main phases of the labor problem are the unemployment question and the task of keeping the cost of labor down at a level which would enable the industry to recover the foreign markets and to maintain there a strong foothold. The unemployment problem was comparatively easier to deal with. It stands, of course, in direct relation to the other problem, as its best solution is to have employment for every one. From the rather haphazard way in which the unemployment problem was at first handled, consisting mainly of treasury stipends toward unemployed, it has soon taken a course of system and order, reflecting the organizing power which is one of the chief virtues of the Germans. The following figures show the percentage of unemployed in the main groups of workmen during the years since the revolution. These figures demonstrate clearly how effectively the matter has been dealt with.

	1919	1920	1921	1922
January	7.9	3.6	3.7	1.7
February	8.0	3.6	4.1	...
March	4.8	2.1	3.7	...
April	6.8	2.2	4.4	...
May	5.0	3.8	4.4	...
June	3.8	5.9	3.4	...
July	4.2	10.0	2.8	...
August	4.8	8.7	2.3	...
September	4.1	5.9	1.4	...
October	3.9	4.9	1.4	...
November	3.8	3.8	1.2	...
December	3.6	3.4	1.3	...

The great business boom starting in 1919 helped to absorb a large number of the unemployed, and cleared the field for the systematic work which the government had undertaken. The system of public stipends has not been abolished, and will probably have to be maintained for many years to come, in view of the number of war invalids. These stipends increased in the course of time with the growing cost of living. A family with three children, for instance, receives now 49.75m. per day. This is approximately 40 to 50 per cent of the pay this family would receive if its bread-winner were employed. It is not supposed to satisfy normal wants, but to keep the wolf from the door. It harbors sufficient dissatisfaction to make its receiver keen for obtaining employment. The government is, however, applying some more forcible means in the latter direc-

tion. An entirely new organization of the labor exchanges has been brought into existence for such purpose. The private labor exchanges have been nationalized, and the offices dealing with unemployment stipends put into close relation with the public labor exchanges. Regular reporting of receivers of stipends at the labor exchanges is compulsory. Although there are still some laggards who succeed in circumventing these regulations, their number is insignificant. The number of stipendiaries on March 1 was 209,000, of which 179,000 were male and 30,000 female. The number of family members of unemployed was 301,000. The total of stipends amounted in February to 114 million marks.

As it cannot be hoped that the labor exchanges will remove all the unemployed from the payrolls, and a certain residue has to be taken care of even under the most favorable circumstances, the aim of the government has been to make the huge outlay for unemployed subsidies productive. A special government department was drafted off for the organization of what is called "Productive Arbeitslosen Fürsorge"—or productive providential care of workmen. The main object of this institution is to provide work of a temporary character for unemployed on enterprises financed by the state treasury or other public funds; this work includes irrigation, hydro-electric power stations, building houses for agricultural laborers, improvement of highways, water works, river regulation, quarries, building and house-wrecking. Over 400,000 unemployed have in 1921 been given work of this kind, and nearly three-fifths of the stipends have in this way been made productive. The scope of this organization has in the course of time been extended, chiefly in the direction of transferring workmen from one calling to another, according to the dictates of demand. Courses of training are maintained for such purpose. A great number of workmen who have crowded into the cities during the war have in such way been led back to the country, chiefly into agriculture. Financial assistance is even extended from means at the disposal of this organization to support private enterprises whose maintenance lies in the public interest.

Unemployment Insurance

A project has been under contemplation at an early date to develop this organization into an unemployment insurance. A law was drafted for this purpose but has apparently been shelved for the present. The object of it is to provide subsidies in the case of unemployment and sickness, also toward workmen not fully employed. The present organization, especially the public labor exchanges, play an important part in this scheme. The funds for this purpose are to be raised, one-third by the insured, one-third by the employers, and one-third by public means, that is, one-sixth part by the state, one-ninth part by the province, and one-eighteenth part by the municipalities. The claims for insurance are established if the insured has, for 26 weeks in the two years previous to his unemployment, paid his insurance fees. The subsidies granted are fixed by the Labor Ministry. They commence seven days after the beginning of unemployment. Earnings from odd jobs are deducted. Every unemployed person has to report at a labor exchange at least three times a week. During the first two weeks he has to apply to the labor exchange of his profession, thereafter at the general labor exchange. Subsidies cease if the insured refuses to accept work offered him by the labor exchange, provided this work is paid by the usual wages and is in keeping with his education or training. The latter proviso ceases after eight weeks, after which time he cannot claim relief on this account unless he can make plausible that his future career would be jeopardized by the acceptance of inferior or inadequate work.

The insured can be compelled to undertake a course of training for a different profession or an additional training in his calling. If he refuses, subsidies will be stopped for the next four weeks. The same applies to employees who voluntarily give up their jobs, or lose them by their own fault. It is a peculiar fact that the proposed law also provides for subsidies to strikers, but only after the first two weeks of the strike. In a similar way, ill people or short time workers are taken care of. If the unemployed want tools for a job offered them, which they cannot pay for themselves, such tools can be loaned them from insurance funds.

Keeping Wages Down

The second and most important task of the labor problem, to keep the level of wages down as low as possible, has two sides, a mental and a material one. The first is frequently overlooked by foreign students of the matter, although it can easily be understood that the workingmen would not acquiesce in a state of affairs which, in spite of appearances, implies for them privations, at least a lowering of their living standard, without some potent agency working upon their minds. This agency consists in the main in the belief that German goods are at a discount in foreign countries, and could not be sold abroad except by cutting prices considerably. Systematic and extensive propaganda was made demonstrating this "discount of hatred" as it is called, with the result that it is now deeply rooted in the mind of the whole population. Foreign legislation against dumping, establishing high import taxes which could easily be traced to discrimination against German goods helped to maintain this belief and strengthen it.

The workmen fully convinced by the same propaganda that the future of the country depends on the export, and aware that a cutting down of the export would materially react upon their own welfare, see no help but to moderate their own claims, not willingly, but as something inevitable. They would probably offer greater resistance than they do, even show fight, if they could refute the contentions brought forward by the employers, that they are greatly handicapped in comparison with their foreign rivals, by the so-called socialistic achievements, the eight-hour day, shop council law, and all the other parts of more or less socialistic labor legislation. Even under such circumstances it would be doubtful if the workmen would submit to the pressure exercised on the level of wages, in the comparatively resigned spirit which they are showing, were it not for the conciliatory influence of the trade unions. The latter have since the revolution gained largely in importance. They have become part and parcel of the government, exercising a strong influence on legislation. Knowing well that by lending help to a contest which would react upon the country's most vulnerable spot, the export, they would largely lose influence on both sides, they are following a policy of temporizing, acting as intermediaries in the conflict between the interests of employers and employees. Storm and stress have put some able leaders at the head of the trade unions, and they no doubt have in mind the welfare of the country as a whole.

The material side of the problem is taken care of by a whole network of regulations drawn around the adjustment of wages, organizing to a nicety the whole procedure. Claims of the workmen for higher wages are subject to strong influence, having a tendency to tone them down to the best possible compromise. This procedure is very successful, and if it is not, it is at least a lengthy one, giving employers the benefit of a level of wages long after claims for their rise have been brought forward.

The regulations created since the revolution have also tackled the problem of strikes. From the original conception of a rebellion, strikes have been moved into an atmosphere of law and order. A nicely defined distinction is now drawn between justifiable strikes and so-called "wild strikes." A strike is considered justifiable only after all means of settlement have been exhausted, and in such cases the unions will back the strikers. In the other instance, it would be a "wild strike" and the strikers could expect no assistance from the trade unions. It will be remembered that the recent railroad strike broke down on the latter account, having been declared a wild strike by the associated trade unions, with the result that help from this quarter was refused.

(To be continued next week)

Smelting Company Loses Suit

The American Smelting and Refining Co. has lost its case against the Government for recovery of $512,515 on account of the sale of copper to the Ordnance Department during the war. The company had a contract with the Government for delivery of copper at 23½ cents a pound, made in March 1918. Before deliveries were completed thereon the Government raised the price of copper to 26 cents. The smelting company sought to obtain 26 cents a pound for copper deliveries after this price advance. The Court of Claims ruled against its contention and the company took the case to the Supreme Court. In a decision announced by the court last week by Justice Holmes, the decision of the Court of Claims was affirmed, although the court said there was doubt as to whether the company could sue the Government for damages arising out of the contract.

The Co-ordinating Machinery of Government

Last year the expenditures of the Federal Government totaled $5,538,040,-689.30. The routine work in handling such a vast sum is enormous. By the imposition of a unified plan and policy upon the business organization of the Government, large savings have been effected. The total expenditures during 1922 will be more than $1,600,000,-000 less than those of 1921. A part of that reduction must be credited to the economies effected by the clearing house organization within the Bureau of the Budget, over which the chief co-ordinator presides. The chief co-ordinator is Col. H. C. Smither, of the General Staff of the Army, who has been thrice cited for distinguished military service and who holds the Distinguished Service Medal for his work in organizing the supply section during the period of the arrival of American troops in France.

The co-ordinating machinery which the Government has set up is simply the plan which has long been in successful operation among the very large industrial enterprises, modified to suit the special needs of the executive departments. The working of this machinery was described by Col. Smither on May 17, when he addressed a large gathering of industrial engineers at Philadelphia. The meeting was conducted under the auspices of the Atlantic Chapter of the Society of Industrial Engineers.

Col. Smither said that there are few business organizations within the United States whose operations are of sufficient magnitude to be comparable with the business of the Government, and these few have recognized that on a scale so large, the central direction of operations can be conducted successfully only by co-ordination instead of consolidation. The suggestion is being offered continually as a business principle that the similar business routine functions of Government should be consolidated in a single body that shall serve all departments. Those who propose such amalgamation of functions are influenced by a desire to conform to the usual practices of single business institutions in the commercial world. They seldom have the information at hand to enable them to recognize whether these functions are sufficiently alike in character to make possible a homogeneous organization or whether the advantages to be gained, if any, are sufficient to offset the loss of initiative to which the separate subdivisions of the Government inevitably would be subjected.

An organization, while influenced in the efficiency of its operation by the fact that the individuals composing it aré subject to human emotions and are possessed of varying degrees of intelligence, is none the less a machine and its capacity to perform its work is measured by precisely the same units that determine the potentiality of a mechanical power unit. The potential energy of which it is capable is a function of its solidarity as a body, coupled with flexibility in arrangement such as will facilitate the transaction of business by the separate elements of the organization with the desired dispatch. There must be sufficient compactness in the body of the Federal organization to permit of the efforts of its separate business elements being directed without either dispersion or congestion of their working forces and at the same time permit of the deployment of each department of its own particular forces with a speed commensurate with the need of the department in the accomplishment of its mission.

It is apparent that the underlying principle of co-ordination is to bring into the Federal organization as a whole that quality which corresponds to the mass of a power unit and to permit dispatch in the transaction of

COL. H. C. SMITHER

business at a rate commensurate with its needs. Too rigid a control may act to depreciate the speed factor to an extent so great as to interfere materially with the separate elements of government in the accomplishment of their respective missions. It follows as a corollary that the principle of organization on a large scale is a flexibility in the organization as a whole, coupled with freedom of action by its units all directed harmoniously to a common end.

Unless every act contemplated in securing co-ordination is carefully considered as to its effect upon these two factors of mass and speed, there is always danger that mere personal opinions may be mistaken for principles.

Government Cuts Ordinary Expenses in Half

Ordinary expenditures of the Government for the ten months period from July 1, 1921, to April 30, 1922, amounted to $2,819,876,115.40 as against $4,277,863,186.23 in the corresponding period ending April 30, 1921.

Expenditures for the month of April amounted to $242,560,-961.82. The largest item was the interest on the public debt which amounted to $121,822,-074.35. The Treasury expended $46,616,328.82, the War Department $35,241,287.96, the Veterans Bureau $33,760,477.19, and the Navy Department $23,-481,074.86. The expenditures under the Transportation Act were $43,537,901.60.

Chamber of Commerce of the United States in Convention at Washington

At the close of its four-day convention held in Washington last week, the Chamber of Commerce of the United States elected Julius H. Barnes, of Duluth, Minn., president for the next year. Vice-presidents elected were A. C. Bedford, of New York; Thomas E. Wilson, of Chicago; Harry Black, of Galveston; and Thomas B. Stearns, of Denver.

One of the most important addresses of the convention was that delivered on Tuesday morning by Arthur Balfour, vice-president of the Association of British Chambers of Commerce, and a prominent steel manufacturer in England. Mr. Balfour's words touched on many of the problems which are facing the industrial world both in Europe and in America today. On the question of exchange rates he remarked that the less politicians and governments have to do with attempts to adjust the exchange, the sooner we are likely to reach a safe and steady basis on which we can trade.

Speaking of labor conditions in England he said: "I am able to report to you many distinct and hopeful signs in Europe and particularly in Great Britain. We have had great labor disturbances in England and so long as the government interfered between the employer and employee no settlement was ever reached which the particular industry could support from an economic standpoint. It is an impossible situation for a government which depends on votes to endeavor to adjust wage questions between employer and employee, and the government of Great Britain has now realized this fact and has definitely stepped out of the arena. The consequences are that wage adjustments are now being made between the two interested parties."

Mr. Balfour declared that in his opinion attempts by some countries to shut out German goods were poor business economics. In the first place, as Germany has to do some export trade it is much better to let her spread this trade normally over the world rather than to control specific markets. In the second place, if she is to pay reparation she can only do so by trading, as in this way only can she secure currency acceptable to the Allies.

The attempt to run Russia on Communistic or Bolshevik ideals has proved a vast and complete failure, according to Mr. Balfour. He explained how Bolshevik propaganda had been spread throughout Europe in an attempt to force other countries to come to the aid of Russia, as a return for the withdrawal of this propaganda.

In closing his address Mr. Balfour said: "I can say to you that in England certainly, and in some of the other countries, we have seen the worse. We are reaching economic conditions where trade on a proper basis will again be possible and I am hopeful that before the end of the year trade will begin to flow in its normal channels and the disastrous unemployment will gradually pass away."

At the Wednesday morning session John R. Delafield of New York gave an interesting discussion of the allied war debt to the United States. He discussed the effect of the payment of principle or interest of this debt upon the United States exports and on the home market. "Where there is unem-

ployment," he said, "the purchasing power of the people becomes limited correspondingly, for it is the workers who are also the consumers. Prosperity requires the greatest number of consumers at home as well as abroad, and by cutting down on the industrial and agricultural activity of the country through any cause, we also diminish the home market by impairing the purchasing ability of our own people.

"The effect of the repayment of these loans and of the interest upon them will therefore, be cumulative, and will, in itself, not only diminish our export trade, but also cut down our home consumption. The less exports, the less domestic trade, for the buying power of our people is diminished.

"It is for us, then, to do all we can to overcome this handicap, and certainly not to do anything to increase the disadvantage under which we labor. What is the amount of these foreign debts to us, repaid as they will be over a long series of years, beside our prosperity and the well-being of our people? Even the amount of these loans is but small compared with the great increase of wealth our country would create in a period of great economic prosperity."

In his address "American Relations to Russia," Secretary of Commerce Hoover analized this problem from an economic standpoint. He offered strong arguments against frequent assertions that the United States is responsible for the situation in Russia today. His remarks, backed by his intimate knowledge of the situation, created a strong impression on his audience. In concluding his address he said: "When all is said and done, the great problem still stands out. Russia is slowly dying because the dynamic forces of production and foreign confidence have not yet been restored. We, a great Christian people, look with horror and deepest sympathy upon her untold miseries. We wish to find foundations in realism for assistance to the Russian people. To extend this help requires a vast restoration of confidence. It requires a restoration of the processes of business and commerce. Russia is making progress in these directions. We wish to help but where does lasting help lie except in the firm and final re-establishment of those basic fundamentals that we have already stated?"

On Tuesday afternoon the cornerstone for the chamber's new home was laid in the presence of over five thousand business men and government officials. The building is situated in Lafayette Square, facing the White House.

During the course of the convention the chamber passed several resolutions expressing its opinions on questions of moment. One of the resolutions urged that the United States take steps to be represented officially at the deliberations of the reparations commission: Another resolution expressed the desire that the United States take its place with the other nations of the world in the International Court of Justice. The chamber also, by resolution, urged Congress to enact legislation which would aid in the speedy settlement of war claims against the governments of Germany, Austria and Hungary. Resolutions also repeated the recommendations in favor of government aid to the merchant marine, and requested congress not to reduce the authorized personnel of the Army and Navy below the strength conservatively requisite for national safety.

Business Items

The Hoggson & Pettis Manufacturing Co., New Haven, Conn., has taken over the six-story building, of which it has occupied part, and is equipping it to take care of expanded lines including the Sweetland lathe chuck, marking devices and rubber molds.

The Bristol Company, of Waterbury, Conn., manufacturer of recording instruments, has opened a branch office in Philadelphia at Room 1311 Widener Bldg. C. C. Eagle, Jr., service engineer, is in charge.

The Pryibil-Genzlinger Machine Co. has been organized in New York City with offices at 220 West 42nd St. P. Lester Pryibil, formerly vice-president and general manager of the P. Pryibil Machine Co., of New York, and Frederick M. Genzlinger, mechanical engineer, are the partners.

Gaston & Co., Inc., of 165 Broadway, New York City, has purchased the business of Gaston, Williams & Wigmore, Inc., of New York. The personnel of the old company will not be changed. Through this New York branch, and that of Gaston, Ltd., of London, the organization will continue to represent manufacturers and aid them in marketing their products.

The J. M. White Motor Co. has been appointed distributing agents in the Sioux City, Iowa, district, for the Wills-St. Claire Motors Co.

The Sigwart & Ralston Machine Works, Inc., Pittsburgh, Pa., has been sold to the Luster Coated Sheets Co.

The Hofius-Hudson Machinery Co., has been incorporated at Tacoma, Wash., with a capital stock of $40,000. Directors are R. S. Holt, 1115 Fidelity Bldg., Tacoma; George J. Danz, Hill Hudson and Phillip Kitchin.

The R. C. Hyde Company has opened offices in the Security Mutual Bldg., Binghamton, N. Y., and is prepared to handle general power plant and mechanical engineering commissions, including electrical installations, power plant equipment, testing and machine design.

The William H. Wilson Iron Works of Rochester, N. Y., manufacturer of structural iron, fabricated steel shapes for bridges and buildings, etc., has opened an office in the Powers Building in Rochester. This office will handle the designing, estimating and engineering work and will be under the direct supervision of L. M. Sanford, who for several years has been in charge of the structural department of the plant.

The Westgate Metal Products Co., has been organized at Oakland, Cal.; capital stock reported $2,500,000. The concern will manufacture castings, tools and fixtures. Directors are A. T. Burch, B. I. Marshal, A. L. Stedebaker, D. S. Riggs, Antone Weber and J. M. Shaw.

The National Steel Barrel Co., of Cleveland, Ohio, has established a plant at 1500 Tchoupitoulas St., New Orleans, for the manufacture of steel barrels. The district manager is S. H. McAllister. The plant has a capacity of 1,200 steel barrels a day and is intended primarily to look after the increase of oil for export from this city.

Plans for a new commercial and passenger car axle factory for Cleveland, Ohio, were announced last week by Viggo V. Torbensen, former president of the Torbensen Axle Co. The new concern will be known as the Vig-Tor Axle Co., and Mr. Torbensen will be president. Associated with him will be A. L. Kroesen, vice-president and general manager; W. N. Jackson, treasurer; Carl R. Harrison as secretary.

The Babcock Printing Press Manufacturing Co., New London, Conn., manufacturer of printing presses, etc., has increased the capital stock of the company from $650,000 to $800,000, to be utilized for business improvements.

The Lux Clock Manufacturing Co., Inc., Waterbury, Conn., manufacturer of clocks and time systems, has increased its capital stock from $150,000 to $300,000.

The Hartford, Conn., office of the Detroit Steel Products Co., Detroit, Mich., was discontinued on May 1, and was consolidated with the New York office of the company, at 110 West 42nd St. D. C. Sullivan, manager of the Hartford office, will become affiliated with the New York branch.

The Graham Manufacturing Co., of Torrington, Conn., has filed papers of incorporation under the laws of Connecticut to engage in the manufacture of metal goods, etc. The capital stock is $150,000, and the incorporators are: James H., Joseph F., and C. A. Graham, of Torrington. The concern recently obtained a lease on space just opposite the Torrington Railroad station, and will begin operations.

Personals

DAVID B. RUSHMORE, chief engineer of the power and mining department of the General Electric Company, has been appointed to the staff of consulting engineers of the company.

COL. ARTHUR HATCH, president and general manager of the Canada Steel Goods Co., Hamilton, Ont., has been elected president of the Canadian Manufacturers' Association.

ARTHUR JENNER, factory superintendent of the Noiseless Typewriter Co., Middletown, Conn., has resigned that position. He will take a trip to Europe, returning to the United States late in July.

DR. CHARLES E. A. WINSLOW has been appointed health supervisor of the new department of the Safety Institute of America. This department will study the influences which affect the health of industrial workers and will make such recommendations for curing them as may seem fit. Dr. Winslow is professor of public health at the Yale School of Medicine, and has been prominently identified with health organization in the United States and Europe.

MARVIN E. MONK has been appointed assistant sales manager in charge of general sales of the U. S. Ball Bearing Manufacturing Co., of Chicago. Mr. Monk was formerly special sales engineer for Manning, Maxwell & Moore,

Condensed-Clipping Index of Equipment

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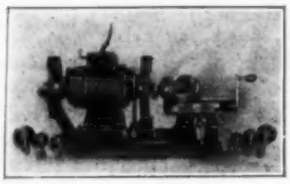
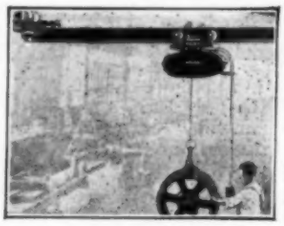
Grinding Machine, Valve-Facing and Tool, Collins
Ford C. Close Co., Inc., 2 Rector Street, New York, N. Y.
"American Machinist," February 2, 1922



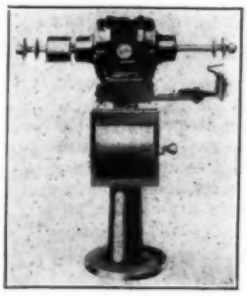
The device is used for precision work in surfacing valves and valve seats of automotive engines. A ¼-hp. motor carries a 6-in. grinding wheel at each end of the spindle. The motor speed is 3,450 r.p.m. for either direct or alternating current. The left wheel is for grinding cutting tools, and the right wheel is for facing the conical surfaces of the valves and for grinding the reamers used in cutting the valve seats. A transverse screw adjusts the valve for the proper depth of cut. Longitudinal motion is given to the work by the feed screw crank.

Crane, Electric, Hand-Power
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
"American Machinist," February 2, 1922



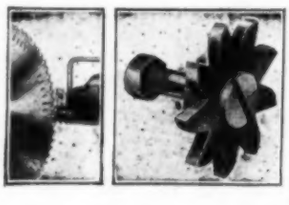
The crane is equipped with an electric hoist controlled by a push button at the bottom of a pipe carrying the handle, or can be furnished with a chain block suspended from a trolley for hand operation. In the former, the operator controls with one hand the raising, lowering and moving the load, and with the other hand steadies the load. The crane has a capacity up to 1 ton. The outfit can be furnished in different lengths with a maximum distance between runways of 24 ft. The I-beam depth varies from 7 to 10-in., but a 26-ft. I-beam can be furnished.

Buffer and Grinder, Motor-Driven, Floor Type
Valley Electric Co., 3157 S. Kingshighway, St. Louis, Mo.
"American Machinist," February 2, 1922



The machine is adapted to use in tire shops, machine shops, buffing and polishing rooms. The motor shaft is extended and threaded at both ends. The inclosed motor is mounted on a heavy cast-iron pedestal, on the front of which is a safety switch. A tool-rest, guards and a driving pulley may be furnished. The motor, furnished with ½ to 4 hp. and either single-phase or two or three-phase, operates on 60-cycle current of either 110, 220 or 440 volts, and has a speed of 1,800 r.p.m. Floor space, 14 in. in diameter. Weight, 130 to 330 pounds.

Chip Remover, Saw-Tooth, Automatic
Henry Disston & Sons, Inc., Philadelphia, Pa.
"American Machinist," February 2, 1922



This device consists of a special toothed wheel, made to fit any type of saw, and a stud to carry the wheel, as shown in the illustration at the right. It keeps the saw teeth and gullets free from chips, as the chips from the cut are apt to stick to the sides and points of the teeth and score the work, or even cause breakage of the teeth. This trouble is particularly noticeable when cutting soft stock. The application to the saw is shown at the left.

Lathe, Center-Driven, Axle
Reed-Prentice Co., Worcester, Mass.
"American Machinist," February 2, 1922

This machine turns both ends of the rear axles of automobiles and mine-car axles. The center portion of the work is gripped to provide the necessary torque, and cannot be machined. The drive to the headstock spindle is from a motor of at least 7½ hp., controlled by a treadle at the front of the machine. Each carriage has its own automatic feed trip, although both are driven by a single set of gearing. The machine will turn shafting up to 2⅞ in. in diameter, with slight modifications to 3½ in. in diameter. Bed, 9 ft. Distance between the centers, 72 in. Length, 10 ft. Width, 40½ in.

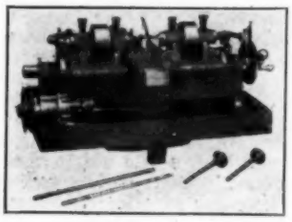
Reamer, Expanding, Heavy-Duty, "Bull-Dog"
Wetmore Reamer Co., 62 South 27th St., Milwaukee, Wis.
"American Machinist," February 2, 1922

The tool can be furnished with either six, eight or ten blades, according to the reamer size. The blades are set at a left-hand angle, with the front cutting edge on a 3-deg. angle. All threads are milled on centers, and the blade seats are ground with the threads as the locating points. The cone nut and graduated screw give adjustment to a thousandth of an inch. An adjustment wrench is furnished with each reamer. The tongue driver relieves the strain on the coupling nut.

Grinder, Electric, Alternating-Current, Bench and Floor
Standard Electric Tool Co., Cincinnati, Ohio.
"American Machinist," February 2, 1922

The machine is fitted with double-row ball bearings and has a Westinghouse motor equipped with a circuit breaker and furnished for either 110 or 220 volts, in single, two or three phases. The wheels used are 8 in. in diameter, have ¾-in. face and ⅝-in. hole, and extend in front of the body of the motor for grinding long and irregular castings and bars. One coarse and one fine wheel and a 10-ft. reinforced cord and plug are furnished. A make-and-break switch is located on top of the motor. Weight, bench machine, 110 lb.; floor machine, 225 pounds.

Milling Machine, Valve, Duplex
Dale Machinery Co., New York, N. Y., and Chicago, Ill.
"American Machinist," February 2, 1922



The machine is intended for milling key-slots in automotive valve stems and similar work. It has two heads, each with its own spindle and pulley and collet chuck for holding the end milling cutter. A device holds the heads stationary while cutters are changed or adjusted. The work is held in a V-block. The cutters operate simultaneously. Feed is obtained through a ratchet operated by mechanism at the rear. The machine handles work up to ½ in. in diameter, and will mill slots up to ¼ in. in diameter and ½ in. long. Bench space 20 x 16 in.

Clip, paste on 3 x 5-in. cards and file as desired

Inc., New York City. J. J. Torpey will continue as assistant sales manager in charge of bearing distribution.

J. MARTIN DUNCAN, follow up engineer of the Detroit Steel Casting Co., Detroit, Mich., has been promoted to be general sales manager. He is being succeeded by E. R. Young. Mr. Allen, formerly sales manager, has been made assistant general manager.

DAVID WING, who has been associated prominently with many of the Government's activities touching coal, has been designated by Secretary of Commerce Hoover to act as the department's point of contact with trade associations desirous of discussing plans for submitting their statistical data to the department.

GEORGE W. SANFORD has been chosen general manager of the Bristol Brass Co., Bristol, Conn., brass manufacturers. He is at present engaged as purchasing agent for the City on the new High School building in Bristol, and will take over his new duties just as soon as he is completed with this work. Mr. Sanford was at one time with the Marlin-Rockwell Arms Co., New Haven.

HARRY W. BLIVEN, general sales manager of Harvey Hubbell, Inc., manufacturer of electrical goods, machine screws, machine products, etc., of Bridgeport, Conn., has recently been elected vice-president of that company. Mr. Bliven has been associated with the Harvey Hubbell Co. for over twenty years.

GARRETT W. B. BLANCHFIELD, of Hartford, Conn., has been appointed New England manager of the Peerless Weighing Co., of Detroit, Mich., manufacturers of weighing machinery.

Obituary

WILLIAM J. HENIFER, assistant chief of the reclamation department of the Aluminum Company of America, was killed by a locomotive in the yards of the company at Massena, N. Y. He was 33 years old.

SAMUEL L. MINER, a director of the Morris Machine Tool Co., Cincinnati, Ohio, died in that city on May 3. He was 82 years old.

FRANK W. EDWARDS, sales engineer for the Dayton Engineering Laboratories Co., died at his residence in Dayton, Ohio, from an acute attack of pneumonia. He had been associated with the Delco organization for more than a decade.

JOHN J. BRUCE, president and treasurer of the John J. Bruce Foundry Co., Cincinnati, Ohio, died in that city on May 16. He was 72 years old.

FRANK D. CHRISCADEN, assistant sales manager of Wicks Brothers, Saginaw, Mich., died at his home in that city on May 15.

LEGRAND SKINNER, founder of the Skinner Engine Works, Erie, Pa., died last week in his home in that city.

H. ZURCHER, JR., secretary-treasurer of the Canton Bridge Co., died last week at his home in Canton, Ohio. He was 42 years old. He had been associated with the Canton concern for the past 21 years.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

An agency is desired by a company in Sweden for the sale of technical novelties, electro-technical material, machinery, and other such articles. Quotations preferred c.i.f. Swedish port. Reference No. 2020.

A mercantile firm in Sweden desires to purchase packings, beltings, wood-working and iron-working machinery, and foundry machinery and requisites. Quotations should be given f.o.b. American ports or c.i.f. Swedish ports. Terms: Cash against documents or upon receipt of goods. Reference No. 1865.

The purchase is desired by a firm in Spain of piping for ships, copper plates, steel wire bound with hemp, raw steel for making tools, steel files, machinery for repairing ships and ship's motors, etc. Quotations should be given c.i.f. Spanish port. Correspondence desired in Spanish. Reference No. 2074.

A business man in Italy desires to open several quick shoe repair shops similar to those in the United States, and wishes to purchase machinery and full equipment for them. Terms: Cash against documents. Reference No. 2075.

An inquiry has been received from a firm in India desiring to purchase crude-oil engines of 10 to 50 horsepower, suitable to run flour mills, rice hullers, oil presses, sawmills, etc.; structural materials, such as beams and girders; and hardware, such as hinges, bolts, screws, nails, plates, bars, and needles. Quotations desired c.i.f. port of India. Terms: Cash with order. Reference No. 2048.

The purchase is desired by a firm in England of steel tubes and electrical accessories in large quantities. Quotations preferred c. i. f. English port. Shipment should be made via Liverpool or Manchester. Reference No. 2022.

Trade Catalogs

Cold-drawn Steels. Pittsburgh Tool Steel Wire Co., Monaca, Pa. A 24-page booklet describing a line of cold-drawn steels,—tool, alloy and high-speed steels, keystock, needle bar stock, Norway iron and welding wire.

Colt Autosan. Colt's Patent Arms Manufacturing Co., Hartford, Conn. A circular describing the recently perfected No. 21 washing machine for metal parts. The machine is illustrated in its various phases of operation.

Flexible Shafts. N. A. Strand & Co., Chicago, Ill. Catalog No. 22, describing and illustrating a complete line of flexible shafts and equipment. Several types of machines are shown, equipped with this shafting, for drilling, tapping, grinding, reaming and other operations.

Shapers and Milling Machines. The John Steptoe Co., Cincinnati, Ohio. A large and well-prepared catalog describing and illustrating the line of Steptoe shapers and milling machines. Various models are shown, with their special features described in detail.

Newark Gear Cutting Machines. Newarg Gear Cutting Machine Co., Newark, N. J., Catalog No. 3, describing a line of Newark spur gear cutting machines. The pages are profusely illustrated with photographs of the machines and their parts. Specifications for several models are included.

Sprague Electric Drive for Newspaper Presses. Sprague Electric Works, New York City, N. Y. Bulletin No. 48,717, describing some recent improvements in electric motor drives for all sizes and types of newspaper and other printing presses. Types of motors and controlling apparatus are shown, as well as actual installations of the systems.

Book Reviews

The Engineering Index for 1921. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York City. About six hundred pages, 6¼ x 9¼ in., bound in red cloth-boards. Price $6.

A carefully selected summary of articles taken from over six hundred engineering and technical publications. Each item contains the exact title of the article indexed; the author's name, if given; the name of the periodical in which the article appeared; the volume, number and date of publication. There is also included a brief note summarizing the contents of the article. The items are arranged alphabetically and are cross-referenced, making it easy for the reader to locate any article wanted. The index contains over 1,400 such items.

Tensile Properties of Some Structural Alloy Steels at High Temperatures. Technologic Paper No. 205, of the Bureau of Standards, Department of Commerce, by H. J. French. Complete copy of the paper may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price five cents.

In the production of ammonia by the Haber process, gradual elongation and ultimate fracture of bolts in converter chamber heads have introduced serious operating difficulties, indicating the need for exact information on the high temperature tensile properties of various alloy steels. The paper gives the determination of tensile strength proportional limit, elongation, reduction of area and strength at fracture throughout the range 20 to 550 deg. C. for four steels containing about 0.38 per cent carbon, as follows: plain carbon steel; 3½ per cent nickel steel; 3 per cent nickel; 1 per cent chromium steel; 1 per cent chromium; 0.2 per cent vanadium steel.

Microphotographs of the fractures, as well as tables and curves illustrate the results. Of the four steels tested in normalized condition, the two alloys containing chromium showed greater resistance to weakening by increase in temperature to about 550 deg. C., and at this highest temperature the chromium-vanadium steel was preferable from its high tensile strength and limit of proportionality. Carbon and 3½ per cent nickel steels behaved alike with rise in temperature, and at about 550 deg. C., the addition of nickel had small effect on tensile properties of carbon steel. At 550 deg. C., the strength and limit of proportionality of chromium-vanadium steel were more than twice that of carbon steel, while the ductility of the former, as measured by elongation and reduction of area, was half the latter, though still quite high. Below 475 deg. C., the strength of nickel-chromium steel was greater than chromium-vanadium and both showed higher strength values from 20 to 550 deg. C. than carbon or 3½ per cent nickel steels. The fractures of carbon and 3½ per cent nickel steels at about 550 deg. C. showed a tendency to follow the grain boundaries, while the fractures of chromium-vanadium steel appeared largely transcrystalline.

Forthcoming Meetings

American Society for Steel Treating: Pittsburgh Section meeting, Bureau of Mines Auditorium, Pittsburgh, Pa., May 25 and 26.

American Foundrymen's Association: Annual meeting, Rochester, N. Y., week of June 5. Secretary, C. E. Hoyt, 140 South Dearborn St., Chicago, Ill.

American Railway Association: Section III, Mechanical: Annual meeting, Atlantic City, June 14 to 21. (Formerly the Master Car Builders and the Association of Master Mechanics.)

Society of Automotive Engineers: Summer meeting, White Sulphur Springs, W. Va., June 20 to 24. C. F. Scott, 29 West 39th St., New York City, is chairman of the convention committee.

American Society for Testing Materials: Twenty-fifth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 26 to July 1. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

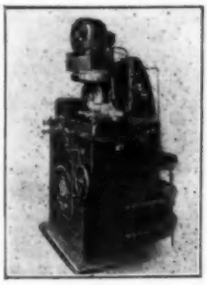
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Reamer, Taper, "Cutwell"
Bickford-Switzer Co., Greenfield, Mass.
"American Machinist," February 2, 1922.

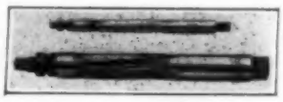
The reamer has three right-hand helical flutes. Two of the lands are relieved clear up to the cutting edge, while the third land is relieved for only about two-thirds of its width, leaving the remainder of circular section to act as a steadyrest. The reamer can be best driven by power. A chucking or hand reamer for parallel-sided holes is made with three equally spaced and fully relieved cutting lands, midway between two of which is a narrow unrelieved land which acts as a steadyrest.

Grinding Machine, Hob, Automatic, Motor-Driven, No. 815.
H. E. Harris Engineering Co., Bridgeport, Conn.
"American Machinist," February 2, 1922.



The machine grinds either right- or left-hand helical flutes, and sharpens form cutters, Curvex cutters or gear cutters, singly or in gangs. The head and motor can be swiveled about the wheel center line. Besides the 1-hp. motor driving the spindle, a ½-hp. motor drives the table, the indexing mechanism, the work-rotating mechanism, and the pump. A helix can be cut on work 8 in. in diameter to 47 deg. either right or left. The indexing head is heavier than formerly with longer bearings farther apart. The machine will index from 2 to 26 divisions. Controls located at the front, can be adjusted while the wheel is running. Table feed, 28 ft. per minute.

Reamer, Expansion, Spiral-Fluted
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," February 2, 1922.



The adjustment provides a range of sizes for each reamer. The helical flutes give free and clean cutting action. The helical blades pass safely over the corners of keyways. The reamer is equipped with a locknut to hold the size, and a safety stop which prevents over-expansion and indicates the maximum limit. The reamers are made in all the regular sizes.

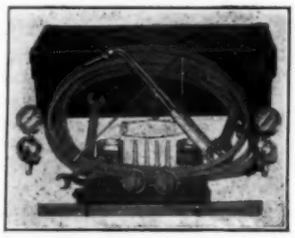
Gages, Square-Anvil, "Trusform"
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," February 2, 1922.

In the adjusting and locking device two opposed headless setscrews in the frame pull against each other. Square anvils permit of working up to a shoulder, and give a larger wearing surface. This type of anvil is interchangeable with the round-head type, and new anvils may be substituted at any time.

Drill Stand, Bench, Lever-Feed
United States Electrical Tool Co., Cincinnati, Ohio.
"American Machinist," February 2, 1922.

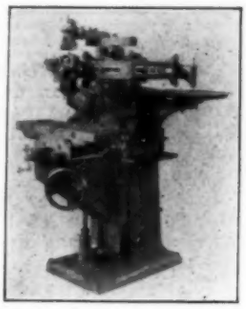
The stand holds portable and electric drills so as to adapt them to precision work. The drill may be easily clamped on the sliding head of the stand, and fed to the work by means of a hand lever. The height of the drill above the table is adjusted by sliding the head on the vertical column. The base is provided with T-slots. The stand is adapted to automobile garage and repair shop work, and holds ¾ or ½-in. portable electric drills. Weight, 68 pounds.

Welding Outfit, Garage, Acetylene, "American," No. 55.
Alexander Milburn Co., Baltimore, Md.
"American Machinist," February 2, 1922.



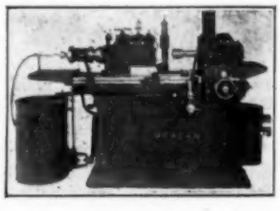
The outfit is intended for both welding and carbon burning and is packed in a fiber carrying case. The "American" torch is 16 in. long, and of the balanced-pressure type. The gas tubes are made of seamless tubing, while the torch head is made from solid wrought brass. All mixing of the gases occurs in the tip. The torch is provided with five tips of different sizes. The outfit includes hose and connections, welding rods and flux, goggles, gloves and a lighter.

Engraving Machine, Motor-Driven, No. 1-S
George Gorton Machine Co., Racine, Wis.
"American Machinist," February 2, 1922.



The machine is heavier and has a greater capacity than the former machines; it cuts dies, steel stamps and large-size letters in steel, brass and cast iron. The pantograph is adjustable to give a ratio of reduction of from 1:1 to 6:1, or a larger pantograph may be furnished having a reduction of 2:1 down to 8:1. Longitudinal table travel, 17½ in. Saddle crossfeed, 8¼ in. Speed 1,800 to 8,000 r.p.m. Table, 10 in. wide, 30 in. long. Depth, 48 in. Width, 60 in. Height, 68 in. Weight, 1,800 lb. Export box, 148 cu. ft.

Grinding Machine, Internal, "Hydroll"
Greenfield Tap and Die Corporation, Greenfield, Mass.
"American Machinist," February 2, 1922.



High traverse speeds are employed on the machine. The wheel spindle is carried on a slide controlled by a feed screw calibrated for feed increments of 0.00025 in. The work table reciprocates upon ways and carries a work head for holding and rotating the piece. The table traverse speed is controlled by the regulation of a sensitive throttle valve. For large bearing races with straight holes, a special workhead is provided. A single hand lever controls all table motions. A pedal is used to stop and start the work. Table speeds, 2 to 36 ft. per minute.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Fla., Lake Wales—The Johnson Motor Co., (automobile repairs), A. Johnson, Mgr. —machine shop equipment and machinery, (used).

Fla., Oldsmar—Oldsmar Mfg. Co.—machine shop and foundry equipment.

Ga., Columbus—T. Huston Mfg. Co.—30th St., C. R. Medley, Pres.—one 24- to 30-in. engine lathe, equipped with taper attachment, four-jaw chuck, steady rest, etc. (used.)

Md., Baltimore—C. E. Stevens Bros., Inc., 124 Hopkins Place, (manufacturer of bags)—lathe, 12- or13-in. swing (used).

N. Y., Falconer—Progressive Machine Co., West Main St.—lathes, drilling machines, power presses and other machine shop equipment.

N. Y., Gouverneur—The Gouverneur Welding & Machine Wks., Park St., F. Scozzafava, Purch. Agt.—acetylene welding outfit suitable for heavy work, also small used 18 in. hand lathe.

N. Y., Jamestown—Third & Lafayette St. Garage, S. G. Robbins, Pres.—machinery, tools and equipment.

N. Y., New York—Hopp Bros., 132 West 14th St.—3 power shears and 1 36 in. square.

N. Y., Niagara Falls—F. Tanbellini, 2461 Cudaback Ave.—tools and machinery for proposed garage and repair shop.

N. Y., Olean—Lucas & Marra, 33 North 1st St.—machine tools and equipment for improved auto garage and repair shop.

N. Y., Sacket Harbor—R. Gowing Co., Main St., (boat manufacturer), R. Gowing, Purch. Agt.—14-16 in. back geared engine lathe and upright post drill, (new or used).

N. Y., Westover—Boland & Bartlett, (machine shop and garage), C. Bartlett, 131 Hawley St., Binghamton, Purch. Agt.—complete machine tool equipment for motor repair station.

O., Columbus—The Carroll-Thompson Co., 555 East Long St., J. L. Thompson, Pres.—one grinder for service station.

O., Columbus—Snyder Auto Co., 70 South 4th St., H. B. Snyder, Purch. Agt.—one drill press, one grinder and 2 or 3 raised racks for turning over autos for repairing.

O., Columbus—C. Zimmerman & Sons Co., 269 Broad St., P. Seeds, Service Mgr.—lathe, grinder and new equipment for service garage.

O., Painesville—The Ohio Mfg. Co.—small circular shear.

Pa., Grove City—P. Hassel—machinery and equipment for garage on Mercer-Grove City Pike.

Pa., Phila.—C. B. Leonard, 2429 West Allegheny Ave., (machinist)—lathes, boring machines, milling cutters, etc.

Pa., Phila.—The Pennsylvania R.R., 18th and Filbert Sts., S. Porcher, Purch. Agt.—small machine tools and number of riveters.

Pa., Pittsburgh—The Flannery Bolt Co., Vanadium Bldg.—1¼ in. Landis bolt cutter.

Pa., Sharon—New Bell Garage, South Irvine Ave.—machinery and equipment for garage.

Pa., Sharpesville—L. Moderella—tools, machinery, etc., for small auto shop, also air compressor and tire shop equipment.

Va., Richmond—A. Reeves, 311 West Broad St.—grinding machines and lathe.

Wis., Osse—C. J. Amundson—equipment and machinery for auto repair shop.

Wis., Milwaukee—American Sheet Metal Works, 255 Lake St., C. Koch, Purch. Agt. —power punch for 19 gage plate.

Wis., Milwaukee—F. R. Dengel Mfg. Co., 336 4th St., plumbing supplies—additional machine tools including lathe and drill press.

Wis., Milwaukee—Wisconsin Grey Iron Fdry. Co., 39th Ave. and Burnham St., J. A. Burke, Purch. Agt.—several electric power molding machines.

Wis., Plymouth—The Central Garage, C. C. Arndt, Secy.—small power machinery and equipment for auto repairs.

Ont., Chatham—Weaver Mfg. Co., Richmond St., W.—tools and machinery for the manufacture of garage equipment.

Ont., Kingston—T. Watson Co., Ltd.—equipment for machine shop and foundry and for the manufacture of concrete mixers, crushers, and road machinery, including steel working machinery, lathes, drills, etc.

Ont., Kitchener—R. Kleinschmidt, Frederick St.—equipment for new garage and repair shop.

Que., Montreal—A. Brabant, 88 Shannon St., equipment for garage and repair shop.

Ont., Ottawa—The Board of Control, City Hall, A. F. Macallum, Engr.—Will receive bids until May 30, one variety saw, one Buzz planer or joiner, one Ball threading machine, one Universal tool and cutter grinder, one power forcing press, one Scleroscope, one combination gas furnace, one kerosene asphalt tool heater, two 2¼ in. diameter Ingersoll-Rand drills, one small portable gasoline operated air compressor, one quarry jackhammer or hammer drill.

Machinery Wanted

Fla., Loughman—The Everglades Cypress Co., J. W. Tucker, Mgr.—engines, sawmill equipment and machinery.

Fla., Tilton—Thorn Reed Lumber Co., address, H. P. Thorn, Martinsburg, W. Va., Purch. Agt.—woodworking machinery for the manufacture of spokes, axe handles, etc.

Ga., Macon—Willingham Sash & Door Co., O. P. Willingham, Jr., Vice-Pres.—one 48-in. or 49-in. sander, late type.

Ga., Savannah—Georgia Cane Syrup Co., 103 West 43rd St.—machinery for bottling syrup, hot syrup filters, etc.

Ill., Elksville—The Journal, (newspaper) —power paper cutter.

Kan., Neosha Falls—The Post—newspaper press, job press and equipment.

Ky., Sadieville—New Eva Milling Co., W. W. McCabe, Pres.—machinery and equipment for mill (feed, grain, etc.).

Mich., Cathro—L. Austin—shingle mill.

Mich., Detroit—The Curtis Co., Lafayette Blvd.—miscellaneous presses and printing machinery.

Minn., Minneapolis—Bd. Educ., 305 City Hall, G. F. Womrath, Business Supt., will receive bids until May 25, refrigerating machinery for Northeast, Roosevelt Junior and Jordan Junior High Schools.

Minn., Walker—The Walker Creamery, C. E. Rausch, Prop.—5 or 7 hp. motor, lineshaft, hangers, pulleys and belting; 2 galvaninzed iron storage tanks, 4 x 2 x 10 ft. and 2 x 2 x 8 ft. respectively, also one water pump with motor.

Mo., Joplin—C. L. Clark, 2402 Empire St., (machinery dealer), H. Johnston, Purch. Agt.—heavy belting, shafting for concentration mill for mines.

Mo., Joplin—The Labor Tribune, 4th and Joplin Sts., D. Grafton, Purch. Agt.—8 column power press for daily newspaper also 3 linotype machines.

Mo., Kansas City—Fuller & McClintock, Produce Exchange Bldg., J. R. McClintock, Purch. Agt.—traveling cranes, water tube boilers, water wheels, large high duty air compressors, crank and fly wheel pumping engines, radial block stacks, stokers, centrifugal pumps and coal handling equipment.

Mo., Kansas City—J. M. Pate, Andover 7—Universal woodworking machine.

N. C., Goldsboro—The Utility Mfg. Co., J. L. Borden, Pres.—new machinery for proposed veneering plant.

N. C., High Point—Ellison Furniture Co., O. H. Ellison, Purch. Agt.—woodworking machinery, including carving spindle, mortising machine and dove-tailer.

N. C., Mt. Pleasant—A. M. Haithcock—flour mill machinery.

N. C., Shelby—A. P. Weathers—ice making and cold storage plant machinery and equipment.

N. J., Clayton—C. Haegle, (machinist)—one nickel plating outfit with attachments complete.

N. J., Newark—Kraeuter & Co., Inc., 563-585 18th Ave., attention of W. H. Hall. "Hawker" adjustable rod and dowel machine complete with regular equipment, range of cutter head ¼-in. to 2-in. diameter.

N. Y., Binghamton—F. E. Harris Co., Stack Bldg.—machinery and equipment for extract factory on Griswold St.

N. Y., Buffalo—Republic Light Heat & Power Co., 173 Winspear Ave.—drilling machinery, cables, etc., for use in extensive drilling operations at Forestville, N. Y.

N. Y., Buffalo—Webb Clean Sweep Co., Inc., 87 Troup St.—machinery for the manufacture of sweepers, brooms, etc.

N. Y., Buffalo—J. Zwelling, 222 Mulberry St.—equipment for sheet metal works.

N. Y., Catskill—The Recorder—flat bed press for power equipment.

N. Y., Endicott—Interstate Limestone Corp., E. E. Kellogg, Little Meadows, Pa., Purch. Agt.—machinery for making concrete blocks and bricks; special forms and shapes for building tiles; mixer and tamper.

N. Y., Forestville, (Chautauqua Co.)—Arkwright Natural Gas Co.—well-drilling machinery, bits, cables, pipe and other miscellaneous equipment for drilling operations.

N. Y., Gouverneur—The Love & Love Co., Barnes St., manufacturer of truck bodies, H. Love, Purch. Agt.—woodworking machinery for the manufacture of automobile truck bodies, also forge and blower.

N. Y., Harrisonville—The Gazette—one 17 column newspaper power press.

N. Y., Margaretville—The News—newspaper power press.

N. Y., Mount Morris—Mount Morris Canning Co.—semi-automatic apple and fruit paring machines, also other canning factory machinery and equipment.

N. Y., New York—Young & Hyde, Produce Exchange Bldg., (contracting engineers)—2 hand power shears, portable, to cut 12 in. beams.

N. Y., Niagara Falls—E. V. Nutting, 449 10th St.—machinery, tools and equipment for plating works.

N. Y., Pike—C. Ellis—cooling machine, 8 x 6 x 10-ft. for market.

N. Y., Pulaski—J. W. Bonney—$1,500 worth of wood working tools and equipment.

N. Y., Rochester—The Rochester Gas & Electric Corp., Clinton Ave., N., J. P. Haftenknapp, Engr.—miscellaneous equipment for proposed liquid gas pumping station.

N. Y., Watertown—The International Burr Corp., 500 Newell St., F. W. Aiken, Purch. Agt.—special machinery for the manufacture of newly patented pulp stone grinding burr.

O., Cleveland—City of Cleveland, c/o Purchasing Dept., is receiving bids until June 1, for 2 industrial trucks and charging apparatus for the new public hall.

O., Cleveland—King Tool Grinding Co.—small machinery and tools.

O., East Columbus—W. C. Hardy & Co., James Pike—concrete block making machinery.

Pa., Phila.—J. B. Connors, 603 East Indiana Ave., (dryers and weavers)—additional machinery for new dye house.

Pa., Phila.—Fay, Kaiser & Sailer Inc., Front and Clearfield Sts., silk and wool manufacturers, L. A. Fay, Mgr.—carders, looms, feeders, drawing frames and other machinery.

Pa., Phila.—The Hensel Colliday Co., 12th and Wood Sts, manufacturer ribbons, silks, etc.—delivery systems, conveyors, chutes, feeders, looms, roving frames, improved twisters, etc

Pa., Phila.—I. J. Horstman Co., 315 Fitzwater St., manufacturer of woolen goods—carders, roving frames, improved twisters, etc.

The Weekly Price Guide

Rise and Fall of Market

Advances—Metals show added demand and prices move up along the list, electrolytic copper now quoted at 14c., lead at 6c., copper sheets at 19.75c., and babbitt metal, fair grade, at 30.80c. Pig iron is quoted from $1 to $4 higher. Brass rods at Cleveland, advance 50c. Old metals show large gains in New York and Cleveland, heavy copper at 1.75c. higher, and tea lead quoted at 4c. Washers advance 50c. to 1.25c. at New York. Castings are firm.

Declines—A leading dealer in shop supplies cuts quotations on machine bolts, lag screws and rivets.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.52
Northern Basic	25.02
Southern Ohio No. 2	22.50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.56
BIRMINGHAM	
No. 2 Foundry	17.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	26.36
Virginia No. 2	28.34
Basic	23.50@25.50
Grey Forge	25.00
CHICAGO	
No. 2 Foundry local	22.50@24.00
No. 2 Foundry, Southern, sil 2.25@2.75	24.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.16
Basic	25.00
Bessemer	26.96

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Pittsburgh	9.0	6.0	3.0
Philadelphia	8.5	5.0	3.0
Atlanta	5.5	4.5	4.0
Detroit	7.0	4.5	3.0
Birmingham	12.0	6.5	3.0
Denver	8.0	6.0	5.0
New Orleans	6.0	4.5	3.5
Minneapolis	9.0	6.0	4.5
New York	9@10	6.0	3.0
Cincinnati	6.0	5.0	4.5
Cleveland	6.75	4.5	2.6
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 40	3.48	3.15	3.38
No. 12	2.45	3.53	3.20	3.43
No. 14	2.50	3.58	3.25	3.48
No. 16	2.70	3.68	3.35	3.58
Black				
Nos. 17 and 21.	3.00	4.15	3.55	4.10
Nos. 22 and 24.	3.05	4.20	3.60	4.15
Nos. 25 and 26.	3.10	4 25	3.65	4.20
No. 28	3.15	4 35	3.90	4.30
Galvanized steel sheets:				
Nos. 10 and 11.	3.15	4.35	3.75	4.30
Nos. 12 and 14.	3.25	4.45	3.85	4.40
Nos. 17 and 21.	3.55	4.75	4.15	4.70
Nos. 22 and 24.	3.70	4.90	4.45	4.85
No. 26	3.85	5.05	4.60	5.00
No. 28	4.15	5.35	4.90	5.30

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	71	58½	⅜ to 1¼	44½	29½
		LAP WELD			
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1¼	69	57½	⅜ to 1¼	44½	30½
2 to 3	70	58½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	8.00	6.00	6.00
Coppered Bessemer rods(base)	7.00	8.00	6.03
Hoop steel	3.38	2.81	3.13
Cold rolled strip steel	6.25	8.25	6.35
Floor plates	4.70	4.66	4.98
Cold finished shafting or screw	3.35	3.00	3.30
Cold finished flats, squares	3.85	3.50	3.80
Structural shapes (base)	2.58	2.41	2.38
Soft steel bars (base)	2.48	2.31	2.28
Soft steel bar shapes (base)	2.48	2.31	2.28
Soft steel bands (base)	2.98	....	2.88
Tank plates (base)	2.58	2.41	2.38
Bar iron (2.00@2.10 at mill)	2.48	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
⅜	8.00		12@13
⅛	6.50		11@12
1/16 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York			14.00
Tin, 5-ton lots, New York			32.25
Lead (up to carlots), St. Louis, 5.40; New York			6.00
Zinc (up to carlots), St. Louis, 5.27½; New York			5.62½
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	6.25	7.50	6.25
Copper sheets, base	19.75	20.00	23.00
Copper wire (carlots)	14@14.50	16.50	16.25
Copper rods (ton lots)	18.25	21.50	19.50
Copper tubing (100-lb. lots)	21.75	23.00	23.00
Brass sheets (100-lb. lots)	16.25	17.50	18.75
Brass tubing (100-lb. lots)	19.00	19.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	13.75	15 50	15.75
Brass wire (carlots)	16.25	17.75	.....
Zinc sheets (casks)	8.00	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J .	39.00	.....	
Solder (½ and ½), (caselots)	23.00	22.00	19 00
Babbitt metal (fair grade)	35.00	40.75	36.00
Babbitt metal (commercial)	15.50	15.50	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS--Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.75	11.75	10.25
Copper, heavy, and wire	11.00	11.00	9.25
Copper, light, and bottoms	9.50	9.00	8.25
Lead, heavy	4.50	4.50	3.65
Lead, tea	4.00	3.25	3.00
Brass, heavy	6.25	5.00	8.00
Brass, light	5.25	4.50	4.75
No. 1 yellow brass turnings	5.75	5.50	5.00
Zinc	3.00	3.00	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.09
Wiping cloths per M., 13¼x13¼	.....	50.00	55.00
Wiping cloths per M., 13¼x20½	.....	55.00	65.00
Sal soda, 100 lb. lots	2.80	2.50	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.95	.95	1.04
White lead, dry or in oil	100 lb. kegs.	New York,	12.25
Red lead, dry	100 lb. kegs.	New York,	12.25
Red lead, in oil	100 lb. kegs.	New York,	13.75
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$3.25@$3.50	
Coke, prompt foundry, Connellsville	per net ton	$4.25@$4.75	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	60–10%	60–10%	60%
1½ and 1¼x3 in. up to 12 in.	60%	60-10-10%	60-10%
With cold punched sq. nuts	40%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	.....	$4.00 off
Button head bolts, with hex. nuts	30%	$3.90 net	.....
Hex. head and hex. nut bolts	35%	.....	65-5%
Lag screws, coach screws	60–5%	.....	60-5%
Square and hex. head cap screws	75—10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	45%	60%	50–5%
Bolt ends, with hot pressed nuts	55%	.....	55%
Tap bolts, hex. heads	+10–15%	.....	.....
Semi-finished nuts ⅝ and larger	70%	75–5%	80%
Case-hardened nuts	65%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$5.00	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	5.00	3.50	3.50
Washers, round plate, per 100 lb. Off list	5.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	3.25	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	3.25	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	3.25	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	3.25	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	60-10%	70%	60-10%
Rivets, tinned	60-10%	70%	4½c. net
Button heads ⅜-in., ½-in., 1x2 in. to 5 in., per 100 lb (net)	$3.70	$3.25	$3.00
Cone heads, ditto (net)	3.80	3.35	3.10
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	60–5%	50%	50-10%
Copper burs	40%	50%	.....
Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine oil, lubricating, (50 gal. bbl.) per gal.	0.45	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50%	50–5%	60–10%
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40 10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.49
Cloth	3.02	.....	3.20

Pa., Phila.—The Kaufman Plush Co., Greene Lane and Venice St.—automatic weaving machines, automatic cleaning trunks, revolving flat cards and other machinery.

Pa., Phila.—B. Nason Baking Co., Knorr and Torresdale Ave.—conveyor system and additional baking machinery.

Pa., Phila.—The Phila. Chair Exchange, 6th and Vine Sts., manufacturer of chairs and furniture—one sticker and one large veneer press.

Pa., Sharon—A. Hromyak—air compressor, tools and machinery for small automobile service station.

S. C., Florence—L. Tyler—box making machinery, (new or used).

S. C., Liberty—Beverly Stone & Sand Co., Inc.—belt-driven air compressor, approximately 800-cu. ft., 100 lb. pressure.

Tenn., Knoxville—Duncan Machy. Co., Dempster Bldg., 721 North Central Ave.—one hardwood flooring machine; end matcher for hardwood flooring; 42 in. band re-sawing machine; 800 cu.ft. belt-driven air compressor; 5 to 50 h.p. 60-cycle, 3 phase, 440-volt motors and 100 and 150 h.p., 60-cycle, 3 phase, 2200-volt motors. (Motors rebuilt or used, in good condition.)

Tex., Beaumont—Stedman Fruit Co., E. Stedman, Pres.—two 10 x 10 cold storage machines with connections.

Va., Front Royal—C. A. Ford, flour mill—complete machinery for small flour mill, (new or used).

Va., Lynchburg—Lynchburg Pigments Corp., W. A. Robertson, Secy. and Mgr.—paint grinding machine, (new or used).

Va., Norfolk—Eureka Bottle Mfg. Co., F. F. Priest, Pres.—bottle manufacturing machinery.

Va., Staunton—C. W. Mongold, (manufacturer of lime, brick, etc.)—machinery for grinding lime, (new or used).

Va., Trammel, (Nora P. O.)—The Sutton Lumber Co.—lumber mill machinery and equipment.

Va., West Point—Chesapeake Corp.—W. C. Gouldman, Secry.—$75,000 to $100,000 worth of machinery for manufacture of pulp board and paper specialties.

Va., Wytheville—Gay-Ola Bottling Co., J. L. Porterfield, Secy. and Mgr.—complete line of soda bottling machinery and equipment.

W. Va., Bluefield—Amer. Fruit Co., H. Charlton, Vice Pres. and Genl. Mgr.—machinery for cold storage plant addition.

W. Va., Piedmont—North Branch Coal Co., P. N. Fahey, Secy.—complete line of coal mining machinery.

Wis., Kenosha—Buick Garage, 915 Salem Ave.—gasoline storage tank and pump.

Wis., Kenosha—F. Pietrangell, 803 Elizabeth St.—equipment for blacksmith shop including forge, drill, grinder.

Wis., Milwaukee—Epstein Bag Co., 615 Cherry St.—special machinery for the manufacture of burlap bags.

Wis., Milwaukee—Lighthouse Superintendent, Federal Bldg., c/o M. M. Works—one stencil cutting machine.

Wis., Milwaukee—Sherman Produce Co., 235 6th St.—ice making machinery, 1 to 2 ton capacity.

Wis., Trippville—H. Wheeler—equipment for proposed blacksmith shop at Glendale.

Alta., Ft. McMurray—The McMurray Asphaltum & Oil Co., Petrolea, Ont., has worked out process for separating oil from the sands, and plans to manufacture special machinery and equipment and develop their lands on a large scale. Receiving bids on separating equipment, pumps, piping and refining equipment. Estimated cost $200,000. T. Draper, c/o owner, Engr.

H. T., Maui, Wailuku—P. W. Eichinger—machinery and equipment for large dairy.

Ont., Beamsville—Culverhouse Bros.—modern equipment for manufacturing jam.

Ont., Dundas—The Crushed Stone Corp.—equipment for crushed stone plant recently destroyed by fire.

Ont., Dunnville—Dominion Fabrics, Ltd.—machinery and equipment for the manufacture of fancy toweling, overdrapes, etc.

Ont., Galt—Newlans Co., Ltd.—special machinery and milling equipment for the manufacture of various grades of plush.

Que., Montreal East—The Hochelage Cement Co., Ltd.—equipment for cement plant.

Ont., Preston—Hurlbut Shoe Co.—shoe making machinery and equipment.

Ont., Smith Falls—International Button Co.—machinery for the manufacture of buttons.

Metal Working Shops

Conn., New Britain—C. D. Ventiano, Church St., has awarded the contract for the construction of a 2 story, working shop, garage and service station, on Church St.

Ind., Ft. Wayne—International Harvester Co. has awarded the contract for the construction of several buildings for the manufacture of motor trucks. D. E. Zimmerman, 611 Chestnut St., Engr.

Md., Port Covington—(Baltimore P. O.)—The Western Maryland Ry., Hillen Sta., has awarded the contract for the construction of locomotive repair shops, here. Cost several hundred thousand dollars. W. C. Byers, Pres.

Mass., Springfield—E. J. Pinney, Inc., 374 Main St., will build a 1 story 100 x 100-ft. garage on Main St. Estimated cost, $40,000.

N. J., Melville—Thompson Machine Co. is having plans prepared for the construction of a 2 story factory—Estimated cost, $150,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Conn., Engrs. and Archts.

N. Y., Jamestown—S. B. Robbins, 31 West 5th St., has awarded the contract for the construction of a 2 story, 80 x 80 ft. garage and shop on 4th and Lafayette Sts. Estimated cost, $40,000. Noted Mar. 16.

N. Y., Johnson City—Boland & Bartlett have awarded the contract for the construction of a 1 story, 50 x 150 ft. machine and repair shop. Estimated cost, $20,000.

N. Y., New York—L. Gold, 2 Rector St., will build a 1 story garage on Columbus Ave. between 204th and 205th Sts. Estimated cost, $175,000.

N. Y., New York—Niewenhous Co., 316 East 161st St., will build a 21 story, 60 x 85 ft. garage on 3rd Ave. and 160th St. Estimated cost, $40,000.

N. Y., New York—T. F. T. Realty Co., c/o Seelig & Finkelstein, Archts., 44 Court St., Brooklyn, will build a 1 story garage on East 3rd St. Estimated cost, $75,000.

N. Y., New York—H. Weprin, c/o V. Mayper, Archt., 156 40th St., is having plans prepared for the construction of a 2 story, 100 x 100 ft. garage at 412 East 55th St. Estimated cost, $50,000.

O., Cleveland—D. S. Blossom, c/o A. Garfield, Archt., Natl. City Bldg., has awarded the contract for the construction of a 2 story garage and service station on Richmond Rd. Estimated cost $50,000.

O., Cleveland—The Champion Rivet Co., East 108th St. and Harvard Ave., plans to build a 1 story factory addition on Dunham Rd. Estimated cost $50,000. D. J. Champion, Pres. Architect not selected.

O., Cleveland—The Natl. Bronze & Aluminum Co., East 88th St. and Laisey Ave., has awarded the contract for the construction of a 1 story, 20 x 150-ft., addition to its factory on East 88th St. and Laisey Ave. Estimated cost $40,000. Private plans.

O., Cleveland—The Stone Improvement Co., Kirby Bldg., has awarded the contract for the construction of a 1 story 42 x 149 ft. garage on East 83rd St. and Carnegie Ave. Estimated cost $45,000.

O., Cleveland—G. W. Walters Transfer Co., 476 East 115th St., is having plans prepared for the construction of a 1 story, 50 x 80 ft. garage and warehouse at 887 East 140th St. Estimated cost $40,000. Private plans.

O., Massillon—W. E. Wagner has awarded the contract for the construction of a 2 story, 48 x 105 ft. garage. Estimated cost $50,000. Noted March 23.

Pa., Grove City—The Bessemer Gas Engine Co. plans to construct a large addition to its plant on Lincoln Ave. Estimated cost to exceed $25,000.

Pa., Phila.—A. W. Barnes, Archt., 10 South 18th St., is receiving bids for the construction of a 1 story, 94 x 180-ft., garage on Bellfield Ave. and Courtland St., for S. H. Marvel, 1607 Hunting Park Ave. Estimated cost $50,000.

Pa., Phila.—The Richter Machine Co., Van Kirk Ave., has awarded the contract for the construction of a 1 story, 50 x 100-ft., machine shop on Erdwick and Van Kirk Aves. Estimated cost $7,000. Private plans.

Pa., Reading—Reading Casting Co. plans to rebuild its casting factory, which was destroyed by fire. Estimated cost, $40,000.

R. I., Anthony—The Coventry Co. has awarded the contract for the construction of a 2 story, 60 x 100 ft. machine shop addition.

Tenn., Chattanooga—The Somerville Iron Wks. has awarded the contract for the construction of an addition to its plant. Estimated cost $750,000.

Wis., Glendale—H. Wheeler, Trippville, plans to build a 1 story 75 x 80 ft. blacksmith and repair shop, here. Estimated cost $40,000. Architect not selected.

Wis., Kenosha—Buick Garage, 915 Salem Ave., is receiving bids for the construction of a 1 story 50 x 125-ft. addition. Estimated cost, $40,000. Private plans.

Wis., Madison—The Bd. Educ. plans to construct a 1 and 2 story, 75 x 80 ft., manual arts shop, including shops for machine work, woodworking, etc., on 5th St. Estimated cost 55,000. Architect not selected.

Wis., Plymouth—The Central Garage plans to construct a 1 story, 54 x 120-ft. garage and repair shop on Division St. Estimated cost $50,000. Architect not selected.

Wis., Racine—The Walker Mfg. Co., Hamilton and Michigan Sts., has awarded the contract for the construction of a 1 story, 60 x 98 ft. addition to its auto accessory factory on Hamilton St. Estimated cost $9,000. Private plans.

Ont., Kingston—T. Watson Co., Ltd., is building a 70 x 100 ft. foundry and plans the erection of 4 other units. Estimated cost, $40,000.

Ont., Kitchener—R. Kleinschmidt, Frederick St., plans to build a garage and repair shop. Estimated cost $40,000.

General Manufacturing

Cal., Visalia—The California Packing Corp., 101 California St., San Francisco, is receiving bids for the construction of a 1 story, warehouse addition to its packing plant here. Estimated cost $20,000. P. Bush, 101 California St., San Francisco, Engr.

Conn., Hartford—The Fuller Brush Co., 547 Asylum St., has awarded the contract for the construction of a 4 story, 80 x 400 ft. plant with 80 x 100 ft. ell, also 120 ton coal pocket, on Windsor Ave. Estimated cost, $500,000. Noted April 6.

Cal., Hanford—The Hanford Ice Co., West 6th St., has awarded the contract for the construction of a 60 ton ice plant on Phillips St.

Cal., San Jose—The Security Warehouse & Cold Storage Co., 350 North 1st St., has awarded the contract for the construction of a refrigerating plant on North 1st St. Estimated cost $23,000. Private plans.

Ind., Indianapolis—Goodman & Co., 615 North Noble St., is having plans prepared for the construction of a 1 story, 100 x 190 ft. hosiery factory on North Noble St. Estimated cost $30,000. Lockwood-Green & Co., 38 South Dearborn St., Chicago, Engrs.

Ind., Indianapolis—C. E. Pauley & Co., 112 East Maryland St., has awarded the contract for the construction of a 5 story, 95 x 135 ft., printing plant on North New Jersey St. Estimated cost $225,000.

Mich., Detroit—The Curtis Co., Lafayette Blvd., has awarded the contract for the construction of a 2 and 3 story printing plant and office building on West Grand and Hamilton Blvds. Estimated cost $125,000.

N. J., Trenton—McCrillish Quigley Co., State St., has awarded the contract for the construction of a 3 story, 60 x 100-ft. printing plant on Wood St. Estimated cost, $75,000.

N. Y., Buffalo—Webb Clean Sweep Co., Inc., 87 Troup St., is receiving bids for the construction of a 40 x 48-ft. sweeper factory on Troup St. Estimated cost $5,000. Architect not announced.

N. Y., Newark—Phillips-Werth Optical Co. plans to build a 55 x 175 ft. optical factory on Willow Ave. and Main St. Cost to exceed $35,000. Architect not announced.

N. Y., New York—The New York Wet Wash Co., 732 East 144th St., has awarded the contract for the construction of a 3 story laundry on Concord Ave. and 144th St. Estimated cost $100,000.

O., Cleveland—Lockwood Greene & Co., Engrs., Hanna Bldg., is receiving bids for the construction of a 4 story, 80 x 140 ft., factory on East 40th St. along the tracks of the New York Central R.R., for Billings-Chapin Co., 1163 East 40th St., paint manufacturer. Estimated cost $200,000. Noted Nov. 24.